LNHS

THE LONDON NATURALIST

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 85 2006

LONDON NATURAL HISTORY SOCIETY

The Society welcomes new members, both beginners and experts. Its recording area (the London Area) lies within a 20-mile (32-km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises Sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology, or rambling, there is a Section ready to help.

Publications

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area and beyond, including records of plants and animals.

The *London Bird Report,* also published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins of news items, including the Society's *Newsletter* and the *Ornithological Bulletin,* are sent to members throughout the year.

Indoor meetings

These are held in most weeks throughout the year, with lectures, discussions, colour slides and films on all aspects of natural history.

Field meetings

Led by experts to visit interesting localities, both within and outside our Area. These excursions are very popular with beginners wishing to increase their knowledge, and enable members to get to know one another.

Library

A large selection of books and journals on most aspects of natural history is available for loan or consultation by members free of charge.

Reading circles

Many important natural history journals are circulated by the Sections at a fraction of the cost of subscribing direct.

SUBSCRIPTIONS

ORDINARY MEMBERS	£20.00
STUDENT MEMBERS	£5.00
SENIOR MEMBERS	£16.00
FAMILY MEMBERS	£4.00
CORPORATE SUBSCRIBERS	£20.00

Student membership is for persons under 18 or receiving full-time education, and senior membership is for persons over 65 who have been continuous members of the Society for ten complete years. All except family members receive one free copy of *The London Naturalist* and the *London Bird Report* each year. Cheques and postal orders, payable to the London Natural History Society, should be addressed to:

The Assistant Treasurer, LNHS,
Robin Blades,
32 Ashfield Road, London N14 7JY

THE LONDON NATURALIST

Further copies of this issue of *The London Naturalist* may be obtained (price £8 plus £1 postage and packing in the UK and the Republic of Ireland) from Catherine Schmitt, 4 Falkland Avenue, London N3 1QR. Back numbers of most recent issues of both *The London Naturalist* and *London Bird Report* are also available from the same address. Cheques should be made payable to the London Natural History Society.

Pink-headed knotweed *Persicaria capitata* on the front steps of a house in Mile End, 12 June 2003. The plants were first recorded there by John Swindells on 22 September 2001 and were still there on 14 July 2006. See page 20. *Photos: George Hounsome*

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LONDON NATURAL HISTORY SOCIETY

Founded 1858

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10 Vivian Road, London E3 5RF

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Editor, *Newsletter:* G. Lyall, 15 The Esplanade West, Sunderland SR2 7BG.

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The Society's Recorders

Botany

Flowering plants and vascular cryptogams: Dr M. Spencer, 72 Michael Cliffe House, Skinner Street, London EC1R 0WX (020-7837 1471).

Lichens: Ms A. J. H. Waterfield, B.SC., 29 Gloucester Crescent, London NW1 7DL (020-7267 8060).

Fungi: Prof. E. G. D. Tuddenham, 17 Bedford Road, London N22 7AU (020-8374 5167).

Bryophytes: M. C. Sheahan, PH.D., 61 Westmoreland Road, London SW13 9RZ (020-8748 4365).

Ecology and Entomology

Mammals: C. Herbert, 67a Ridgeway Avenue, East Barnet, Hertfordshire EN4 8TL (email: armconservation@hotmail.com).

Reptiles and amphibians: T. E. S. Langton, B.SC., 12 Millfield Lane, London N6 6RA (email: t.langt@virgin.net).

Fishes: Dr Ruth Kirk, School of Life Sciences, Faculty of Science, Kingston University, Penrhyn Road, Kingston upon Thames, Surrey KT1 2EE (email: r.kirk@ kingston.ac.uk).

Arachnida: J. E. D. Milner, B.SC., 80 Weston Park, London N8 9TB (email: spiders@acaciaproductions.co.uk).

Coleoptera (Carabidae and Coccinellidae): P. R. Mabbott, B.SC., 49 Endowood Road, Sheffield S7 2LY (email: paulmabbott@blueyonder.co.uk).

Coleoptera (Lucanidae and Buprestidae): Dr D. S. Hackett, FRES, 3 Bryanstone Road, London N8 8TN (email: danielhackett@blueyonder.co.uk).

Coleoptera (families not otherwise listed): M. V. L. Barclay, 47 Tynemouth Street, London SW6 2QS (email: m.barclay@nhm.ac.uk).

Lepidoptera (butterflies): L. R. Williams, 34 Christchurch Avenue, Kenton, Harrow, Middlesex HA3 8NJ (email: leslie.williams1597@btinternet.com).

Lepidoptera (moths), Syrphidae, and invertebrates not otherwise listed: C. W. Plant, B.SC., FRES, 14 West Road, Bishops Stortford, Hertfordshire CM23 3QP (email: cpauk1@ntlworld.com).

Orthoptera: Vacant.

Hymenoptera Aculeata: R. W. J. Uffen, 4 Mardley Avenue, Welwyn, Hertfordshire AL6 0UD (01438 714968).

Heteroptera: Vacant.

Odonata: Neil Anderson, B.SC., 52 Beechwood Avenue, Greenford, Middlesex UB6 9UB (email: neil@anders42.freeserve.co.uk).

Plant galls, Isopoda and Myriapoda: K. Hill, BA, FLS, 93 Elmhurst Drive, Hornchurch, Essex RM11 1NZ.

Mollusca: Vacant.

Records may be sent to the appropriate recorder (where shown) or to Colin Plant who will distribute to each recorder the relevant data from a mixed set of records.

Geology

Vacant.

Ornithology

Inner London: D. Darrell-Lambert, 33 Mary Rose Close, Chafford Hundred, Essex RM16 6LY.

Hertfordshire: A. D. D. Wilson, 7 Douglas House, Davison Drive, Cheshunt, Hertfordshire EN8 0SZ.

Buckinghamshire: A. V. Moon, 46 Highfield Way, Rickmansworth, Hertfordshire WD3 2PR.

Kent and Lower Thames (London Bridge to Tilbury): J. Horton, 65 Castle Lane, Chalk, Gravesend, Kent DA12 4TG.

Surrey and Upper Thames (London Bridge to Staines): Vacant.

Middlesex: R. E. Innes, 27 Dominion Close, Hounslow, Middlesex TW3 1PJ.

Essex: C. Langsdon, School House, Gillespie Road, London N4 1LH.

Requests for information should be made to the appropriate recorder.

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Report of the Society for the year ending 30 June 2005

Approved at the Annual General Meeting on 6 December 2005

By the time this appears in print eighteen months will have elapsed since the end of the year to which it relates, so it would be remiss not to include a brief mention of events in the latter half of 2005. Amongst these, sadly, was the death at the age of ninety-two of Richard Fitter, a former president of the Society. Richard's enthusiasm, matched only by his vast knowledge of natural history in general and London in particular, was an inspiration to all. The secretary's dog-eared copy of *London's Natural History*, awarded as a school prize in 1950, is personal testimony to that. We mourn, too, the passing of Richard Butler, another ex-president and the Society's leading geologist, and Wyn Wheeler, fish recorder for many years and doyen of Britain's ichthyologists.

As honorary vice-presidents of the Society, both Richards were *ex officio* members of Council and hence trustees with legal responsibilities under charity law — not a burden they and others in a similar position necessarily wished to bear. This is one of the issues addressed by the working group set up by Council to revise the Society's rules, last changed in 1979. The Group's proposals, which accompany this report, have been accepted by Council and the Charity Commission and will be put to the membership at the Annual General Meeting in December. If approved, the new rules will come into force immediately.

A small but significant change is the addition of 'recording' to the Society's Objects. For many members this is one of the Society's most significant activities and its species records constitute perhaps the largest and certainly the most comprehensive collection for the London area, with an unmatched historical reach. Last year's report mentioned that discussions had begun with the local records centre, Greenspace Information for Greater London (GIGL), on how it could access these. Encouraged by the National Biodiversity Network (NBN), it has been agreed to start with a pilot study of selected taxa whose recorders hold data on paper or in electronic form. With encouragement from NBN and LNHS, GIGL is seeking support from DEFRA for a staff member to assist recorders with this task. This is an appropriate time to review the Society's policies on species and habitat records, and a working group to consider such matters as their ownership, confidentiality and sensitivity has been set up under our president, John Swindells.

London's Royal Parks are among its best-recorded places and were the theme of Jan Hewlett's retiring Presidential Address. Since stepping down, Jan has represented the Society in a consortium preparing to nominate Downe, Charles Darwin's home in Bromley, as a World Heritage Site. Records for the neighbourhood, both historic and current, will be important to making the case and members wishing to help are invited to contact a member of Council. The environs of Downe are well protected. Not so the lower Lee Valley where the Olympics will be held in 2012. The Society is joining other conservation bodies including the London Wildlife Trust to promote policies to mitigate the consequences for the area with its many species-rich brownfield sites.

A significant event in the wildlife year was the arrival in Britain of the harlequin ladybird, first in Essex, then in south London and now widespread in our district, as carefully documented by our recorder Paul Mabbott. It is a threat to our native ladybirds, and probably here to stay unless an exceptionally severe winter checks its progress.

Membership and communication

At 30 June 2005 total membership was 1,040, slightly up from last year and the first increase, albeit a small one, for some years. Subscription income is generally sufficient to meet the costs of our regular publications while interest on the Society's reserves provides income to support other charitable activities and occasional publications. With a larger membership there would be greater potential for raising Londoners' awareness of the city's natural heritage. Council has appointed Mark Burgess, a Trustee with good contacts, as press officer. If members pass on their news and discoveries to Mark he will endeavour to place them in London-based media such as *Time Out*, the *Evening Standard* and local radio and newspapers.

The Society has contributed to the start-up costs of an annual magazine, *Oasis,* produced by the Royal Parks Wildlife Group for distribution to schools and libraries in London and for sale to visitors to the Royal Parks. The LNHS is featured on the back page.

Having no premises of its own the Society has, since the 1940s, been privileged to use the Natural History Museum as its postal address. Last year, in the context of discussions about areas of possible co-operation, the Linnean Society offered to provide the LNHS with a pigeonhole for correspondence. Located in Piccadilly, this would be slightly more central and accessible to the Society's officers, who agreed to accept the offer. Council are most grateful to the staff of the NHM, most recently our member Stephen Brooks of the Entomology Department, who have been kind enough to deal with mail arriving at the Museum. The new postal address will gradually replace the NHM on all the Society's publications.

The LNHS traces it origins to the Haggerstone Entomological Society, founded in 1858. Council is starting to consider how to celebrate the sesquicentenary in 2008. As plans develop there will be announcements and discussion in the *Newsletter* to which all members are invited to contribute.

Publications and journals

London Bird Report **65** (2000) was published in July 2004. The lengthening intervals between issues continued to concern Council which was accordingly most grateful to Paul Cornelius who agreed to write single-handedly the species accounts for 2001. Unfortunately, personal circumstances prevented Paul completing the task in the time foreseen so the remainder was completed by the editorial team under the leadership of Andrew Self. *LBR* **66** (2001) is due to appear in December 2005. In order to eliminate the backlog, Council took the unusual step of offering paid contracts to write the species accounts for 2002 and 2003, by competitive tender following open advertisement. As a result *LBR* **67** (2002) and *LBR* **68** (2003) will appear as a double issue in 2006. Following reorganization of tasks amongst members of his editorial team, Council expects the *LBR* to return to its usual schedule.

The London Naturalist **83**, for 2003, included for the first time a systematic review of records of fungi, old and new, and a fascinating account of a scandal involving members of the above-mentioned Haggerstone Entomological Society in the nineteenth century. At the AGM in 2004 members expressed concern that publication of accepted papers should not be delayed, and as editor, Keith Hyatt will continue to meet this request as far as possible. The colourful *Newsletter* has been well received. Under its editor Graeme Lyall it is becoming a forum for stimulating correspondence as well as Society announcements and reports.

Research stations

The new Bookham Common Survey hut in the grounds of the National Trust's Merritt's Cottage was formally opened on 9 October by the president

Jan Hewlett in the presence of some forty members and friends. After describing the contribution Ruth Day had made to the Society in general and the study of Bookham and its dragonflies in particular, Jan unveiled an elegant marquetry plaque in Ruth's memory. Thanking the National Trust and its warden, Ian Swinney, for their support, Jan noted that the Ruth Day Memorial Hut would not have been possible without the funds contributed by members and the sterling work and leadership of the Survey's chairman, Ian Menzies. This was a cue for enthusiastic applause and an attack on the excellent refreshments provided by the Survey team.

Beetles have been studied at Bookham since the Survey started. About one-third of the British species have been recorded and an annotated checklist, *The beetles of Bookham Common,* is being prepared for publication. Details will appear in the *Newsletter.*

Keith Cavanagh succeeded Colin Bowlt as chairman of the Hampstead Heath Survey. Jenny and Denzil Devos, as well as running a programme of themed monthly activities for the Survey, have assembled records gathered by many members as the basis for a new *Flora of Hampstead Heath.* At the time of writing, an electronic version of the checklist is being tested with a view to publishing a traditional flora in book form, in collaboration with the Corporation of London.

Sections

Details of sectional activities appear elsewhere but the sheer number of meetings listed in the *Programme* is impressive: Botany Section arranged twenty-five field meetings and seven indoor meetings during the year, Ecology & Entomology Section twelve and five, while Ornithology Section notched up fifty-three and five, giving a grand total of 107 events for members. This is in addition to the monthly meetings at Bookham Common and Hampstead Heath. Sections are now arranging some meetings to cater for members' wider interests in natural history; six meetings were designated 'General' and several others not so named ranged well beyond Sectional topics. A number of meetings, field and indoor, were held jointly with other organizations, following the lead set by the Brad Ashby Memorial Lecture, organized in collaboration with the British Entomological and Natural History Society. The Society was represented at a number of events including the Lee Valley and Rainham Marshes Bird Fairs, Wildlife and Open Days at the Natural History Museum, and the annual exhibition of the Amateur Entomologists' Society; Council is very grateful to those members who give their time to publicize the Society's activities.

Library

Librarian Linda Hewitt added sixty-six volumes to stock, while nearly 200 loans were recorded by the Issues Desk. Records kept by Imperial College show that this is up on last year, and there has been a steady increase in the total for a few years now. Moreover the number of members holding Library cards increased to fifty-two. Linda would like to thank the staff at Imperial College for their continued support at a time when the College's Library provision is under financial pressure.

[A few days after the AGM at which this report was approved, the Society received notice from Imperial College of their intention to terminate the Society's lease at the end of 2006. An alternative home for the Library collection is therefore being sought.]

Conservation and biodiversity

Freda Turtle organized five field meetings of the Nature Conservation Working Group; these are additional to sectional meetings. They cover all

aspects of natural history and members who have not yet attended one are encouraged to do so. David Bevan was again active in his role of conservation officer. At the end of the year David retired from his post with Haringey Council. To celebrate the occasion a party was held for him at Railway Fields, the nature reserve with which he is particularly associated. The event was well attended by David's friends from the Society, delighted that thanks to his efforts Railway Fields had just been awarded 'Green Flag' status by the Civic Trust.

Members of Council (Trustees) 2006

President:	Mr John Swindells
Treasurer:	Mr Mike West
Secretary:	Prof. John Edgington
Elected members:	Mr David Bevan Mr Mark Burgess Mr Rodney Burton Mr David Darrell-Lambert Dr Jan Hewlett Mr Keith Hyatt Miss Pippa Hyde Mr Mick Massie Mr Pat Sellar Mr Michael Wilsdon
Section representatives:	Dr Mark Spencer (Botany) Ms Nicola Duckworth (Ornithology) Mrs Catherine Schmitt (Ecology & Entomology) Dr Ian Menzies (Bookham Common Survey) Mr Keith Cavanagh (Hampstead Heath Survey)

Treasurer's report follows:

Treasurer's report for 2004/2005

At the end of the financial year on 30 June 2005, the total net assets of the Society were £342,529 compared with £342,358 the previous year.

Income for the year totalled £37,212, compared with £34,474 in 2003/2004. Subscription income (including Gift Aid tax recovered) fell slightly from £19,913 in the previous year to £19,287 in 2004/2005. Sales of the Society's various publications generated £1,748, compared with £2,931 in the previous year.

During the previous year the Society disposed of its entire portfolio of listed investments on the closure of Govett Investment Management Ltd, who had previously managed the portfolio. The proceeds were reinvested in the COIF Charities Deposit Fund pending decisions on longer-term investment. The balance held in this fund amounted to £311,000 at the year end, having generated £14,130 interest in the year.

Overall expenditure during the year was £37,041, compared with £28,800 in the previous year, when delays in the production cycle of the *London Bird Report* meant that no report was published in the year.

Reserves policy

The Society's unrestricted general funds can be regarded as expendable endowment since they are invested to provide a regular source of income as well as capital growth, over time.

Statement of trustees' responsibilities

Law applicable to charities in England and Wales requires the trustees to prepare financial statements for each financial year which give a true and fair view of the charity's financial activities during the year and of its financial position at the end of the year. In preparing those financial statements the trustees are required:

- to select suitable accounting policies and then apply them consistently
- to make judgements and estimates that are reasonable and prudent
- to state whether applicable accounting standards and statements of recommended practice have been followed subject to any departures disclosed and explained in the financial statements
- to prepare the financial statements on the going concern basis unless it is inappropriate to presume that the charity will continue to operate.

The trustees are responsible for keeping accounting records which disclose with reasonable accuracy at any time the financial position of the charity and enable them to ensure that the financial statements comply with the Charities Act 1993. They are also responsible for safeguarding the assets of the charity and hence for taking reasonable steps for the prevention and detection of fraud or other irregularities.

Summarized accounts for the year ended 30 June 2005

These summarized accounts have been extracted from the Society's annual accounts for 2004/2005. They may not contain sufficient information to provide a full understanding of the financial affairs of the Society. For further information the full accounts, the Independent Examination report on these accounts and the trustees' annual report should be consulted. Copies can be obtained from the Hon. Treasurer, M. J. West, 52 Trinity Road, Ware, Hertfordshire SG12 7DD.

The annual accounts were approved by the trustees on 11 October 2005.

Summarized statement of financial activities for the year ended 30 June 2005

	Unrestricted general funds 2005 £	2004 £
Incoming resources		
Activities in furtherance of the charity's objects:		
Subscriptions received from members	19,287	19,913
Publications/journals income	1,748	2,931
Interest receivable	14,833	5,271
Investment income	—	3,093
Donations and other income	1,344	3,266
Total incoming resources	**37,212**	**34,474**
Resources expended		
Costs of generating funds	—	(1,194)
Net incoming resources available for charitable application	37,212	32,392
Costs in furtherance of the charity's objects:		
Publications and other costs	32,279	23,673
Grants payable	200	—
Management and administrative expenses	4,562	5,127
Total resources expended	37,041	28,800
Net incoming resources before revaluations and investment asset disposals	171	4,480
Gains/losses on investment assets	—	13,526
Net movement in funds	—	18,006
Fund balance brought forward at 1 July	342,358	324,352
Fund balance carried forward at 30 June	£342,529	£324,358

Balance sheet as at 30 June 2005

	2005 £	2004 £
Fixed assets		
Tangible fixed assets for use by charity	2,724	3,741
Net current assets (including cash deposits)	339,805	338,617
Total net assets	£342,529	£342,358
Represented by:		
Unrestricted funds	£342,529	£342,358

Official and sectional reports for 2005

CONSERVATION

The London Biodiversity Partnership, of which the LNHS is an active partner organization, had a busy year in 2005. As well as continuing to implement its twenty-four habitat and species action plans (details of which can be found on the Partnership's website www.lbp.org.uk), the year saw some significant projects and changes for the LBP.

A Funding Facilitator was recruited in June, to support partner organizations looking for funding and resources to enact the action plans. September saw the culminating event for LBP's first corporate partnership, with Reed Elsevier sponsoring the creation of a reedbed in St James's Park and providing staff volunteers for the project. Perhaps the most exciting news of the year came in November, with the announcement from the Heritage Lottery Foundation, that the partnership's Capital Woodlands Project bid (forming an integral part of the Woodlands Action Plan) had been successful. HLF will be contributing nearly £1m towards this innovative three-year project. This is wonderful news, and a happy outcome of several years' hard work (documented in previous conservation reports), by a number of partner organizations including the LNHS. In December, Froglife joined LBP as a new partner organization, with plans to develop a new Standing Water Action Plan. Finally, towards the end of 2005/6, LBP recruited its first Partnership Manager.

The Nature Conservation Working Group also had a busy year, holding five survey meetings in Tower Hamlets Cemetery Park during 2005. Society members, working with London Wildlife Trust members and conservationists from the Park, collected records relating to the cemetery's flora (including mosses), and fungi. They also surveyed for ants, ladybirds and bumblebees, and established that the bluebell populations were predominantly of hybrid origin. One Society member, Ron Parker, did sterling work recording the flora of the site at both the scheduled visits and on other dates. The survey of Crane Park Island Nature Reserve carried out in 2004 has been assembled into a report, and is now available in the Society's Library.

After several active years committed to organizing the fieldwork of the Nature Conservation Working Group, Freda Turtle has now had to resign this role due to other work commitments. Freda will however continue to act as Secretary, and documents for comment should continue to be sent to her.

DAVID BEVAN, *Conservation Officer,* FREDA TURTLE, *Secretary, Nature Conservation Working Group*

BOTANY

At the AGM in October 2005, Dr Mike Fay, Head of the Conservation Genetics Section at the Royal Botanic Gardens, Kew spoke about techniques of DNA analysis which can contribute to our understanding of the flora of the British Isles. There were no other formal indoor meetings, but there were four informal meetings: an opportunity to see members' best botanical photographs of 2004; an introduction to lichens by Amanda Waterfield; and two identification meetings led by George Hounsome and Rodney Burton. There was the usual varied programme of field meetings; during the winter there were visits to the RHS Library, to Denham and to Epping Forest, and an introduction to conifers at the SLBI. In the spring and summer we went to West Norwood Cemetery (for mosses), Brookwood Cemetery (for conifers), Mile End Park (for beginners — a joint meeting with the Wild Flower Society), St Pancras & Islington Cemetery (for fungi at a less-usual time of year), Castle

Hill in Sussex, Hampton Court, Hounslow Heath, Camley Street Nature Park, Barley-Mo Farm, the River Pinn, Lightwater Bog, a waste ground site in the East End, Runnymede, Ashdown Forest, Fobbing Marshes, Crayford Marsh, the Thames towpath between Putney and Mortlake, and Harrow Weald Common (for ferns). In the autumn there was a visit to Coldfall Wood, Haringey (for bryophytes).

Rodney Burton's plant records database continues to grow. There have been meetings with GIGL, involving representatives of the National Biodiversity Network, to consider how co-operation might develop, which have not had any positive outcome as yet. Detailed comments have been provided on the draft citations of priority vascular plants in the London Biological Action Plan. Our lichen recorder, Amanda Waterfield, has been collating records of *Cladonia* for London and reports that there has been a welcome increase in numbers of species. Ted Tuddenham, fungus recorder, says fungi have been actively recorded this year, with forays organized in East Finchley Cemetery and the Gunnersbury Triangle; there has been a special focus on finding the zoned rosette *Podoscypha multizonata*. Mary Clare Sheahan has been involved in bryophyte recording visits to Bookham Common, Wimbledon Common and Hampstead Heath, and has made a start on entering bryophyte records into MapMate.

Our thanks are due to Robin Blades, who resigned after eight years on the Committee, and to Mary Clare Sheahan who is retiring after serving fourteen years as secretary.

DAVID BEVAN, *Chairman*, SARAH GRAHAM-BROWN, *Secretary*

ECOLOGY AND ENTOMOLOGY

Without an indoor meetings secretary, we have arranged only a few. In January Dylan Walker spoke to us about 'Whales and dolphins in Britain and Europe'. At February's informal meeting three members showed slides on various aspects of the natural world. For our annual joint meeting with the British Entomological and Natural History Society in September, Paul Mabbott, our recorder of Coccinellidae, gave the Brad Ashby Memorial Lecture on 'Invertebrate surveys — can the public help?'.

Our AGM in October 2005 followed the successful formula of recent years with reports from recorders. Clive Herbert, our mammal recorder, presented the main talk on 'Mapping mammals: towards the first London mammal atlas'.

Twenty field trips were organized during the year, a significant increase on six the previous year. This increase is due to the hard work and enthusiasm of Mick Massie.

The text and photos for the Section's home page on the Society's website have been submitted and should soon be posted. Once again the Section represented the Society at the Amateur Entomologists' Society exhibition, selling books and journals as well as making the work of the Society known to a wider public.

On behalf of the Section's recorders, we would like to thank all those who have submitted data.

We would welcome members willing to join us to carry on the work of the Section and the Society.

COLIN BOWLT, *Chairman,* CATHERINE SCHMITT, *Secretary*

ORNITHOLOGY

We had a very successful year with excellent field and coach trips. We took stands at the Lee Valley Bird Fair in February and the Rainham Marsh Open Day in September and had updated our presentation there, by using a computer with slides of natural history. At Rainham, Sarah Barnes had provided some sweets, which offered the perfect opportunity to start talking to visitors.

Our success was marred at the beginning of 2005, when members were shocked to hear of the sudden death of our indoor meetings secretary, Nicola Overington. She had arranged many successful indoor meetings and her death is a great loss to our Society. She had already arranged indoor meetings in January and February on nest boxes and on Tanzania, but no new meetings could be arranged until after our usual break in the summer. We then tried to meet the demand expressed by new members at our Open Day at Barn Elms in 2004 that the Society has indoor meetings on identifying birds and on bird reserves around London.

We began in September with a talk on identifying warblers; one in November on identifying waders and, at our AGM, our chairman David Darrell-Lambert followed up last year's talk on identifying smaller gulls with one on the larger gulls. These meetings have all attracted around thirty members including, as a result of publicity in *Birdwatching* magazine, occasional new visitors. Mr Alan Wingrove has taken over as indoor meetings secretary and is seeking ideas on topics for the meetings. Early in 2006, we distributed a questionnaire to those who went on the coach trip or field trips asking what members wanted. As a result, there will be further talks on identification and on local reserves, but please let Mr Wingrove know if you have any further suggestions.

During the year, Neil Anderson organized seven coach trips to areas which are magnets for birders. The first trip of the year was to the north Norfolk hotspot of Titchwell RSPB reserve. On a cold sunny day there was plenty of interest around the centre with a mixed flock of Arctic, mealy and lesser redpolls feeding in the alders. Black brent amongst the dark-bellied brents and the long-staying black-winged stilt added to the rarity score. There were good numbers of wildfowl and waders and, in the late afternoon, views of hunting barn owl and hen harrier added to a superb trip.

The February visit to Rutland Water was much quieter but it is always good to see the thriving colony of tree sparrows catered for with ready-made homes and supplementary feeding. Egyptian geese are another feature of the reserve.

Dungeness in May was timed for migrants. A bonus highlight was a gull-billed tern on the ARC Pits which showed well. A good variety of seabirds was observed by the patch, whilst wheatears and black redstarts were seen near the Observatory. The reserve highlights included peregrine, little gulls, Temminck's stint and yellow wagtails.

The June trip to Stodmarsh was amid unseasonably cool weather. Marsh harriers and hobbies were well received and a good variety of warblers were present, with a good presence of Cetti's warblers. Turtle doves were eventually found, but were less plentiful than on previous trips. Little egret, garganey and black-tailed godwits were noted too.

A visit to Minsmere in August was timed for wader passage and observing juvenile marsh harriers on the wing. As usual, bitterns put on a good show. In addition to the good tally of waders, common, Sandwich and little terns were observed on the scrapes. In addition to the birds a good selection of butterflies was seen including grayling and wall.

Holme-next-the-Sea was our first autumn outing on a cold but bright day on 1 October. The sea was productive with gannets, Arctic and great skuas and common scoter amongst others. Also good numbers of pinkfeet were arriving across The Wash and landing on the grazing meadows.

The final trip of 2005 was to RSPB Elmley Reserve on the Isle of Sheppey. As usual there were large flocks of dabbling duck (especially teal and wigeon), lapwing and golden plover. The reserve is also noted for its raptors and this was justified with marsh and hen harriers, kestrels, two merlins, sparrowhawk and three short-eared owls seen by the group. A sign of the times was the ever present little egrets on the reserve.

The year ended sadly as our regular coach company Leaside was ceasing these activities. On a positive note bookings picked up as the year progressed.

Our field trips organizer, Jennifer Hayden, reported that the field excursions were very successful in 2005 and she is grateful to all members who came along to the fifty or so arranged over the weekends of 2005. She would especially like to thank all the leaders, without whom the programme would not happen. She reports: 'They are excellent leaders with vast amounts of knowledge, not only in ornithology but also local history and flora and fauna of their areas. The sites varied from local commons, Thames footpaths, and nature reserves to the vast Lee Valley and Epping Forest area, which members could enjoy visiting with an experienced leader. Most importantly, it was the birds which gave us fantastic views; of some we only had a fleeting glance, others tested identification skills, while others skulked and did not reveal themselves at all. One of the joys of birdwatching is that it is not as easy in the field as we seem to think while watching the nature programmes on television: patience, changeable weather and good company lighten the long waits and add enjoyment to the trips.

'Our star attractions in the winter months were smew, goosander and owls in the Lee Valley. The trip led by Robert Callf to Trent Park has great variety and is an ideal spot for woodpeckers and small flocks of tits. There are also large flocks of colourful mandarin ducks which love the old oak woods. Sites such as Wandsworth Common are ideal for seeing stock doves and sparrowhawks. There is a nice flock of house sparrows — which are a delight to hear chirping away. A new site in the programme was Sewardstone, where members were lucky to hear the nightingales singing and to see the newly arrived swifts and sand martins. South London has some beautiful, quiet areas — a visit to Wimbledon Common for bird song made a splendid walk. Sarah Barnes led a visit to Morden Park which is a great place for seeing kingfisher and grey wagtail, and she also helps lead the trips with Derek Coleman at Beddington Sewage Farm. This is a good site to see sandpipers on their late summer passage; there is also the odd avocet which turns up on site. Avocets are also to be seen on Robin Blades' trip to Two Tree Island, which is a good way to start identifying the small flocks of waders which race along the tide line. You may also be lucky enough to catch a glimpse of an egret in the creeks.

'Nearer to home the Thames at Crossness is an ideal place in late October or November to catch up with the big flocks of teal, pochard and wigeon and to watch for bar-tailed godwit and the odd snipe which lurks in the reed beds. It is amazing how many bird species can be found in the London area. Although some species thrive, sparrow, starling and pied wagtails have suffered. We can enjoy the rise in the population of grey wagtails, sparrowhawks and peregrines. I cannot mention every site or all the leaders by name but I must say a big thank you to three people who have for many years been valuable assets to the Ornithology Section. John and Margaret Fitzpatrick and Ken Palmer have all enjoyed taking the walks over many years and now have taken a well-earned retirement — all sadly missed from the programme. I am delighted to have known them and we wish them good health and happiness; I do know that they enjoy reading the newsletters and are still doing a regular walk on their patches. I do hope that members will continue to enjoy the variety of sites visited and to improve their birdwatching in a friendly group with very knowledgeable leaders.'

We have a very good Committee with a great deal of youth and enthusiasm. We have only two Committee meetings a year but they are short and enjoyable. If you would like to help, please get in touch. You do not have to be an expert birder: you only need to bring some ideas on how the Ornithology Section should develop in the future.

DAVID DARRELL-LAMBERT, *Chairman,* ANGELA LINNELL, *Committee Secretary*

Book review

A coleopterist's handbook (4th Edition). Edited by J. Cooter and M. V. L. Barclay. 439 pp., 152 × 217 mm, hardbound. Amateur Entomologists' Society, 2006. £54 incl. p. & p. ISBN 0 900054 70 0. Available from AES Publications, 1 Tower Hill, Brentwood, Essex CM14 4TA (aespublications@btconnect.com).

The *Coleopterist's Handbook* has been, and continues to be, an absolutely essential work of reference for all coleopterists, from beginners upwards, since it was first published in 1954 under the general editorship of W. J. B. Crotch. Subsequently updated and revised in both 1974 and 1991, we now have the excellent fourth edition, complete with a splendid set of coloured plates.

There is little that this new version does not include. An authoritative introduction to the beetle families starts things off, including a checklist of modern family names before each family is discussed in turn by the various contributing specialists. This takes us from page 1 to page 199 and so takes up about half of the work. Although keys to species are absent, pretty much everything else a beetle enthusiast might want to know is here. Subsequent chapters cover, in considerable detail, methods of finding, collecting, preserving and identifying beetles including a detailed section on the examination of genitalia — essential for naming many species. There is also a section on breeding beetles, as well as headings such as Conservation, Creating a database and Recording.

Clearly this tome contains so much information that the reviewer has been quite unable to digest it all — to do so would probably mean waiting a year for the review. However, having read previous editions, it is clear that this revision makes several important changes as well as introducing modern concepts such as computerized record-keeping — quite unheard of in the first edition! This book is a very well-presented easy-to-understand work that forms perhaps the single most important contribution to the British Coleoptera literature for many years and is thoroughly recommended as absolutely essential for anyone with even the remotest interest in studying beetles. All that we who are not experts now need is a revised checklist and some workable keys to identify species in families that were last keyed out in Joy's 1932 *Practical Handbook* or in some obscure and long-out-of-print publication of the Royal Entomological Society. If this too can be achieved, to complement this critically important, if somewhat expensive, revised handbook, I predict a happy and glorious future for coleopterology in this country.

COLIN W. PLANT

Observations and reflections on WEEDS, with particular reference to the wild plants of inner London's pavements, walls, waste places and neglected or undisturbed corners

JOHN SWINDELLS

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Presidential Address delivered at the Annual General Meeting on 6 December 2005

Apart from personal observations the main sources for this address, not always referenced, are Burton (1983), Kent (1975, 2000), Preston et al. (2002) and Stace (1997). The address was illustrated by slides indicated through this text by asterisks.*

Previous presidents of the London Natural History Society, in their Presidential Addresses, have mainly traced aspects of the history of the Society, reviewed changes in the natural history of London over the years, reflected on the role of a local natural history society, or focussed on the natural history of a particular geographical area.

What I shall offer you tonight is none of these. It will be a personal potpourri of London-related botanical reminiscences, reflections and anecdotes. If I had a one-word title for my address it would be **WEEDS**. But immediately anyone uses the word 'weeds' it begs a definition. Can the Internet help me? Not really — *Google* lists 13,000,000 references to weeds on the World Wide Web. Choosing UK pages only brings it down to a more manageable 903,000 references!

When Ralph Waldo Emerson (1803–1882) asked himself, **'What is a weed?'** he decided that it was **'A plant whose virtues have not yet been discovered'** (Emerson 1878: 3). I like that definition but it is not the one I'm choosing this evening.

While I was preparing this address I came across a newspaper report headlined 'Weeds leaves you feeling on a high'. 'Could this help me?', I wondered. No — it was a review of the new Sky One comedy drama series in which a young widowed mother helps to pay the mortgage by dealing in marijuana.

Marijuana, hemp *Cannabis sativa** is cultivated for fibre, birdseed, fishing bait and narcotic production. It has been grown in gardens in Britain from 1304 and known in the wild since 1863. Its cultivation as a drug is illegal in the United Kingdom but apparently not in certain American states, judging by the quantity of books on the subject that I have seen on the shelves of Borders bookshops in New York and Virginia. (After delivering this address I read, but did not note the reference, that Henry VIII required the growing of hemp for its fibre.) I think I saw the plant once, growing near Imperial College Library — but it was dark and next time I came that way in the daylight it was gone.

So, that's one kind of weed.

Turning back briefly to the Sky TV series we find that 'Weeds' takes place in Agrestic, California. Agrestic? Those who know their Latin will recognize that *agrestis* = wild and usually means growing on arable land. This leads us to a more usual definition of weeds — plants growing wild on cultivated land. Many of the most well known carry the word 'corn' in their vernacular names: corn marigold, corncockle, and, perhaps most famous of all, cornflower.

Cornfield weeds

Corn marigold *Chrysanthemum segetum** (pictured with other cornfield weeds) is an archaeophyte, one of those ancient introductions that arrived in our islands before AD1500. Though declining, it is still a fairly widely distributed arable weed of sandy/loamy soils and a common constituent of wildflower seed mixes. Cornflower *Centaurea cyanus** is another archaeophyte that declined severely with seed cleaning and the use of herbicides and now is very rare indeed as an arable weed. However, those who went on the LNHS field meeting to Barley Mo Farm near London Colney, Hertfordshire in June this year (2005) saw thousands of cornflower plants (Swindells 2005). Corncockle *Agrostemma githago** is another of those ancient introductions. It is now reckoned extinct as an arable weed but, like corn marigold, is a frequent component of wildflower seed mixes.

In my part of London, the East End, most of these cornfield weeds turn up only after the sowing of such seed mixes. Do they fit with our romantic view of how the countryside ought to look? They are certainly favoured by the managers of Mile End Park and my two Local Nature Reserves, Mudchute Farm on the Isle of Dogs and Tower Hamlets Cemetery. And on a visit to Cambridge in 2004 I noticed the same practice in odd corners of that city.

Let's look at another favourite cornfield weed, common poppy *Papaver rhoeas**. Here is an archaeophyte which, though sensitive to herbicides, can be abundant in unsprayed strips. This is hardly surprising as poppy seeds can stay dormant in the ground for a long time and in huge quantities. It is estimated, for example, that in Broadbalk Field at Rothamsted, Hertfordshire one acre of land contains 113 million dormant poppy seeds (Salisbury 1961: 329). Mick Crawley (2005), in his recently published *Flora of Berkshire,* states that, 'Some modern farmers encourage it as a food source for game birds by leaving an unsprayed margin round their cornfields.' He also suggests that some of them practise what he calls land art, being quite aware of the effect of the red poppies against newly ploughed white chalky soil and the general green of the rest of the landscape. It reminds me of the Italian flag.

But cornfield weeds don't quite fit my definition of weeds for tonight. Let me try another definition on you. Past LNHS president Rodney Burton, our recorder for vascular plants, tells me that his definition of a weed is **a plant growing where someone doesn't want it**. He's quite right and I shall give you a couple of examples. On the way to the Royal Horticultural Society's Library in Vincent Square to check out some references on weeds I came across a contractor on his hands and knees scraping pearlwort from between the paving stones of one of Westminster's streets. Procumbent pearlwort *Sagina procumbens* is a native species that occurs naturally among rocks, on cliffs and river banks but also grows in a wide variety of artificial habitats including urban pavements. It can stand heavy trampling but it is not a problem plant. I detect an obsession with tidiness. My second example concerns what I call floating window boxes which British Waterways have placed in various places along the Regent's Canal. In a conversation with one of BW's maintenance men I was informed that these boxes were supposed to contain reeds and rushes but that 'weeds grow in them'. Weeds in this instance meant dicotyledenous plants such as great willowherb *Epilobium hirsutum* and others that dared to find their own way there — another example of an obsession with tidiness.

Those are not my weeds for tonight either, so let us look in the *Shorter Oxford English Dictionary* (Onions 1973). As you would expect it offers several definitions. Here's the first: 'A herbaceous plant not valued for use or beauty, growing wild and rank, and regarded as cumbering the ground or hindering the growth of superior vegetation.' Such plants may not be of use to the farmer but the rest of us seem to quite like the pretty cornfield ones like those we've already considered, especially as they now have a rarity and nostalgia value as well — hence their planting in parks and gardens.

A further *Shorter OED* definition tells me that the word 'weed' is used generally for 'Any herb or small plant'. We are getting nearer to my definition for this evening. 'Can another former president help me?', I ask. (Here we looked at a photograph of David Bevan pointing at a street sign which read 'LEADING TO WEEDS'.)

It was Lewis Carroll's (1871) Humpty Dumpty who said, 'When *I* use a word it means just what I choose it to mean'. What I choose to mean by weeds tonight are the sorts of plants that had to wait until volume 5 (the last volume) to get into the National Vegetation Classification (Rodwell 2000) and some that may never get into it. I'm talking of plants that find niches in the inner city and survive despite being trampled on, despite having potential habitats built on, that somehow survive despite the obsession with tidiness and its agents the strimmer and the weedkilling spray. Some are remnants of, or escapes from, cultivation, or they are opportunists that come from other countries, and most are temporary colonists that occupy niches newly created by human activity until some further human activity alters or destroys that niche.

I said earlier that my one-word title for this address would be WEEDS. My full title is **Observations and reflections on WEEDS, with particular reference to the wild plants of inner London's pavements, walls, waste places and neglected or undisturbed corners.** I have long liked those seventeenth and eighteenth century book titles that took up a whole page and this title is in that tradition.

To Richard Mabey (1976) these were 'Street Flowers' to borrow the title of a wonderful little book he wrote thirty years ago. Richard Mabey likes a good story as those of you who have read his books will know, and there are some good stories about the urban wildflowers of London. Let's look at some examples.

Some shrubs and trees

Buddleja or butterfly bush *Buddleja davidii** has been cultivated from the 1890s and was found in the wild in Merioneth by 1922. In the London area it was first noted in Yiewsley by 1928. This is one of the famous plants of the London bomb sites. Its very light, viable, wind-borne seeds take it to walls, railway banks; anywhere it can get a roothold. It is particularly successful at parapet level on the terraced houses of the East End.

Sycamore *Acer pseudoplatanus** was introduced to Britain from the sixteenth century and noted in the wild as early as 1632. Now it is found throughout Britain and Ireland except the most exposed parts of the Highlands and the Western and Northern Isles. Its winged fruits, helicopters to the Swindells family, enable it to spread to many neglected corners, and especially to the boundaries of properties. It can become dominant on unmanaged land and is a major constituent of the secondary woodland in, for example, Tower Hamlets Cemetery.

Tree-of-heaven *Ailanthus altissima** is another escape from cultivation. Introduced to the Chelsea Physic Garden in 1751 from Nanking (More and White 2003), it was not noticed in the wild until 1935, in London from 1944. Pearman (2002*b*: 440) states that it 'spreads by suckering but rarely sets seed in Britain'. In London I would say that it *frequently* sets seed and I've seen examples in Kensington, Limehouse and on the Isle of Dogs. In Paris it is the foodplant of a rather splendid introduced Asian silkmoth *Philosamia cynthia* (Crotch 1956). As a teenager I rather wished that the moth might be found in Britain.

London plane *Platanus* × *hispanica* is a significant London tree, one of the few plants named after London. It is vigorous even in polluted air and copes well with pruning hence its frequent planting in London's parks, squares and streets. Its pollen though is a problem for hay fever sufferers. Like *Ailanthus* and sycamore it regenerates freely and I've seen it frequently in pavement cracks and front basement areas.

Bladder-senna *Colutea arborescens** is known to our family as the 'Popper Tree' because, as children, we had such fun popping its pods. It was introduced to Britain by 1568 but only became naturalized extensively from around 1900. Kent (1975) says that it was 'Planted on railway banks etc.'. I cannot really think why but it certainly spreads along them and to old marshalling yards and other waste places. (The two slides showed it growing at Parkland Walk and on railway land at Gillespie Park.) Kent says that it is 'Common, especially in the East End', and I can confirm that it has recently been present at Bromley-by-Bow, Whitechapel and on the Isle of Dogs.

Laburnum *Laburnum anagyroides** was introduced to gardens before 1596 and in the wild by 1879. Seedlings and saplings are frequent in the squares of central and inner London (Kent 1975). I've seen it in Shropshire as a dominant hedgerow tree and, in contrast, successfully surviving for several years in a pavement crack in Bethnal Green.

Some escaped garden ornamentals

Plenty of garden plants spread by seed or vegetatively from window boxes and hanging baskets or over the garden wall. Among the regulars in London streets are garden lobelia *Lobelia erinus,* sweet alison *Lobularia maritima,* garden pansy *Viola* × *wittrockiana,* and French marigold *Tagetes patula.* Another is snapdragon *Antirrhinum majus**, cultivated since Elizabethan times and found in the wild since 1762. In Middlesex it has been known since 1815. I've seen it in many places including on Thames wharves on the Isle of Dogs, at Notting Hill Gate Station (at roof level) and at South Kensington Station (at track level).

I saw yellow-flowered strawberry *Duchesnea indica** growing, as an escapee, on the steps of the Central Library in Kensington in April 2002 before I ever saw it growing as a garden plant. I have since seen it in profusion in paving cracks in the churchyard of Holy Trinity, Brompton (and after this address was given, in some quantity in a lawn on the north side of Kensington Library in March 2006). *D. indica* was cultivated in Britain from 1805 but not noted in the wild until 1879. In the London area it was not reported until the 1940s. Its strawberry-like fruit is dry and tasteless according to our former president Richard Fitter (Fitter, Fitter and Blamey 2003).

Pink-headed knotweed *Persicaria capitata** (Frontispiece) is described by Stace (1997) as 'An infrequent garden or pot-plant escape not hardy in Britain'. In my experience it is an increasingly frequent garden escape which I've seen for several years in a row in London and Devon. Clement and Foster (1994) gave it a two-spot rating meaning that eleven years ago they were aware of between five and fourteen post-1930 localities. I've seen it in twelve localities, one each in S. Devon, E. Kent, Warwickshire and Shropshire, two in Dorset and six in London. It has survived several successive winters in three of them (Mile End, the Isle of Dogs and Dartmouth).

Trailing bellflower *Campanula poscharskyana** was brought into cultivation as recently as 1931. It was not recorded in the wild until 1957 (in Worcestershire), and not in the London area until 1982 when it was reported on the wall of the Thames at Chiswick, in a street in Chelsea and common as a street weed in Kensington. It escapes to and thrives in basement front areas of terraced houses and 'mansion' blocks and is still present in several Kensington streets.

Yellow corydalis *Pseudofumaria lutea** is a plant that likes a bit of dampness and, like *Campanula poscharskyana,* thrives in front basement areas and on walls in many parts of London. It was grown in Britain by 1596 and found in the wild by 1796. The first record for Middlesex is 1827.

Atlas poppy *Papaver atlanticum** is a more recent arrival, cultivated in Britain from 1889 and plentiful on city rubble in 1946. It increased considerably in 1947, was still plentiful in 1953 but rapidly decreasing by 1957. Kent (1975)

regarded it as extinct in Middlesex but it was found on a wall at Bruce Castle Museum, Tottenham in 1985 (Kent 2000).

Broad-leaved everlasting-pea *Lathyrus latifolius** has been a garden plant in Britain since the fifteenth century and in the wild since 1670. It is particularly successful at spreading along railway banks, on sea cliffs and on waste ground. (One of the slides showed it growing in profusion at Feltham Marshalling Yard.)

Escapes from agriculture

Oil-seed rape *Brassica napus* ssp. *oleifera** (shown growing at Railway Fields in Haringey) is a frequent escape from cultivation which spreads into the inner city via our main roads. 'Only a small amount was grown in Britain until the 1960s/70s. World-wide it now accounts for 13% of oilseed production' (Francis 2005).

Phacelia *Phacelia tanacetifolia** is a nectar plant, green manure, ornamental or seed contaminant which may turn up anywhere. Cultivated in the UK since 1832 and first found in the wild in 1885 there have been single records in recent years from Hampstead Heath, Ken Wood and Mile End Park.

Recently brought in as a weed

Though a common weed in southern Europe, India and parts of North America, prostrate spurge *Euphorbia prostrata** is new to the British flora according to our member, Eric Clement (pers. comm., 2003). It was first found in Limehouse by Mary Clare Sheahan, Tom Fowler and myself when recceing for a Wild Flower Society field meeting in August 2003. Rodney Burton came on that meeting a week or so later and recognized the plant, having previously seen it in Dubrovnik, if I recall correctly.

In 2003 it was growing in two pots containing fan-palm *Trachycarpus fortunei*; reported in the Society's 'Botanical records for 2003' (Burton 2004: 239). In September 2004 it was still growing in the pots but also in cracks in the paving. This year (2005) the pots are gone and at the end of October I found one plant growing out of the paving. Who knows whether this little spurge, a weed of pot plants in the United States, will persist? I'm sure that palms and other exotic ornamental species will continue to be imported and bring with them other accidental immigrants. Though date and other palms themselves can grow from seed in this country I am not aware of their becoming established.

Where did these come from?

Some introduced species are not escaped farm crops, one-time ornamentals or conventional field or garden weeds; they may have been grown originally for medicinal purposes, or as dye plants; they may have come in as contaminants of birdseed, or grain for human consumption, or in a variety of other ways, sometimes more than one or not clear so long after their original arrival. The following is a mixed selection of plants associated with, or spread by, human activity. They are ones which for one reason or another interest me and for which I have been able to borrow slides.

Oxford ragwort *Senecio squalidus**, originally from Mount Etna in Sicily, was introduced to the Oxford Botanic Garden in the sixteenth century and escaped by 1794. Once it reached the railway, in about 1879, the clinker of the permanent way seemed to suit it and it was off. It turned up as a casual in Twickenham in 1867 but did not become established in the London area until the first decade of the twentieth century. It is now to be found throughout England and about half of Wales. Its distribution in Scotland and Ireland is mainly in the major cities and towns.

Perennial wall-rocket *Diplotaxis tenuifolia** is an archaeophyte with a distribution in Britain centred on ports and industrial areas, including London. Kent (1975) notes its abundance in the East End and Lee Valley where I've got used to it, but visiting botanist friends from Manchester were amazed at the quantity of it.

Amaranths *Amaranthus* spp. are a difficult, wholly alien genus says Clive Stace. They can be erect and stately or sprawling and scruffy and they can turn up almost anywhere. I've seen them at the base of street trees in Kensington High Street and along the towpath of the Hertford Union Canal in Tower Hamlets. If they get tidied away before fruiting, as happened to plants I was watching in both places, then they can be very difficult to identify with any certainty. Some species are cultivated for their spinach-like leaves and one, *Amaranthus caudatus*, as a pseudo-cereal crop for its grain (Vaughan and Geissler 1997).

As its name suggests common amaranth *Amaranthus retroflexus** is the most frequent nationally and in London. Green amaranth *Amaranthus hybridus**, here seen in South Tottenham, is the next most frequent. The *New atlas* (Preston et al. 2002) shows a swathe of dots north-east from London. Purple amaranth *Amaranthus cruentus** is thought to be a domesticated derivative of *A. hybridus* which turns up as a rare casual, here as a street weed in Guildford. Prince's-feather *Amaranthus hypochondriacus** is another domesticated species which turns up as a casual, here at Trout Road dump in Yiewsley, in the London Borough of Hillingdon. It turned up on a manure heap at Mudchute City Farm on the Isle of Dogs this autumn.

Thorow-wax *Bupleurum rotundifolium**, another archaeophyte, is probably extinct now as an arable weed but turns up occasionally as a rare casual, usually from birdseed. It is also, however, a commercial florists' flower. 'Since the early nineties, it could be found in almost every yellow, green, or mixed flower bouquet' (Leopold 2001). Often imported from Dutch growers, it can arrive with seeds already ripening and a few years ago Humphry Bowen (2000) predicted that it might reappear in Britain from that source. In June 2000 I found such a plant at the base of a London plane tree only a few metres from a florist's shop in Kensington! (Swindells 2001). Here we see it growing in Rodney Burton's garden.

Thorn-apple *Datura stramonium** was in cultivation in Britain by 1597. It has been used as a narcotic and to treat asthma. Its native range seems not to be known for certain as with many of man's fellow travellers — is it tropical America or the Black Sea region? (Dines 2002). In North America it is known as Jimson or Jamestown Weed after Jamestown in Virginia, the first permanent English colony on the North American mainland, dating from 1607. I mention this because there is a London connection: those English colonists sailed from what is now known as Virginia Quay on the Thames by East India Dock Basin. Sir Edward Salisbury (1961) writes of an exceptionally large thorn-apple plant he once saw which, he calculated, could have produced ¾ million seeds. The seeds can survive many decades which helps to account for its sporadic appearance on disturbed ground. Rodney Burton (1983) mentions its occurrence on Wimbledon Common in the early nineteenth century, in 1935 and then again several years after that. Salisbury mentions that it was 'frequent about London and elsewhere in the eighteenth century'. I've seen it in Mile End Park, on dumped soil on a roadside in Leyton and as a flowerbed weed in Venice.

Henbane *Hyoscyamus niger** has been in Britain from the Bronze Age. It declined markedly in the twentieth century but still turns up from time to time when ground is disturbed where it formerly occurred. Rodney Burton has pointed out that the sort of chicken-run habitat that gave the plant its English name is virtually unknown in the London area. I have seen it in a pig enclosure on Mudchute Farm on the Isle of Dogs in most years since at least 1995 and that's where these photographs were taken.

Woad *Isatis tinctoria** was a dye plant from the Iron Age. Ancient Britons reputedly painted their bodies with it. Apparently the world's last two woad mills, in Lincolnshire, closed in the 1930s (Pearman et al. 2002*a*: 252). Synthetic dyes did for them. I've seen the plant as a street weed in Mediterranean countries and think it could make a splendid addition to London's weed flora. I was not, however, responsible for its introduction to Tower Hamlets Cemetery in the mid

1990s where it survived for a few years. It is long-established in a locality near Tewkesbury in Gloucestershire and another in west Surrey where this evening's photograph was taken. Note its pendulous fruits.

Treacle mustard *Erysimum cheiranthoides** is apparently relatively common in London (Kent 1975) but I have only ever seen it in a few streets in Whitechapel and, much more vigorously, as an arable weed in Breckland. Its long-cultivated relative wallflower *Erysimum cheiri* grows on old, and not so old, walls. Kent (1975) credits Thomas Johnson with the first Middlesex record in 1638.

Apple-of-Peru or shoo-fly plant *Nicandra physalodes** was grown in Britain by 1759 and found wild (in Parson's Green, Middlesex) from 1860. My personal records of the species are from Mile End Park and in Limehouse by the Grand Union Canal. Note the enlarged dark sepals enclosing the fruit.

Cotton thistle *Onopordum acanthium**, photographed here in Leatherhead, is an architectural plant that has been in Britain since the Iron Age but is now frequently grown in gardens and escapes from them. Is it a grass-seed contaminant or spread with manure, or do its fruits just blow in the wind? They certainly get about and there are recent records from Hampstead Heath, Hyde Park, the Zoo, Buckingham Palace grounds, Mile End Park, etc.

Red valerian *Centranthus ruber** has been a garden plant from 1597, recorded in the wild in Cambridge from 1763 and in Middlesex from *c.*1780. A native of S.W. Europe and the Mediterranean, it grows in Britain on sea cliffs and walls, along railway lines and on well-drained waste ground. It is attractive to insects including the hummingbird hawkmoth.

London-rocket *Sisymbrium irio**, photographed here in its classic location by the Tower of London, was first recorded in Britain no later than 1656 (Günther 1922) by John Goodyer 'in ye streets near White Chappell, east from Aldgate, London'. Tantalizingly there is a specimen in the British Herbarium of the Natural History Museum, London (**BM**) with Goodyer's name on it but no date or location. Peter Marren (1999) has called it 'the original urban wild flower'. It was runner-up after rosebay willowherb as Plantlife's county wildflower for London. Why is it called London-rocket? Well, it came to prominence after the Great Fire in 1666 when it was observed in great profusion even to the top of the toppled steeple of old St Paul's. It has fluctuated in abundance in the years since and may have disappeared during the second half of the nineteenth century but was found again near the Tower of London in the 1940s and has been present there ever since. Currently it occurs in a number of streets in Whitechapel as well as Poplar, Stepney, Mile End, the Isle of Dogs and Hackney.

I am surprised that *Sisymbrium loeselii** is called false London-rocket. To my mind it is much more likely to be confused with treacle mustard than any of the *Sisymbrium* species. The plant was introduced to cultivation in Britain in 1787 and first found in the wild on Uxbridge Common in 1883. It is one of those wild plants that most frequently arrives in Britain in bird seed. Note how the flowers have larger petals than *S. irio* and are higher than the fruits which are medium length and at all sorts of angles. I have seen it in two places in Mile End and two on the Isle of Dogs.

Eastern rocket *Sisymbrium orientale** was apparently cultivated from 1737 but first recorded in the wild in Surrey in 1859. It is the commonest of the non-native species of *Sisymbrium* in London and the most widely distributed in Britain and Ireland. This species is found in scruffy corners recently disturbed. Note the very long pods at all sorts of angles.

Perennial rocket *Sisymbrium strictissimum** was found on a few London bomb sites in 1945 but has been present in our area in or near to the churchyard of St Anne's Church, Kew Green for over a century. Was it a deliberate introduction or a casual that survived? Burton (1983) points out that the Royal Botanic Gardens are only just across the Green. Note the entire leaves contrasting with the lobed leaves of the other *Sisymbrium* species just shown.

Tall nightshade *Solanum chenopodioides**, here photographed along the Limehouse Cut, has been known in the Channel Islands since 1958 (where it is currently in five 10-km squares). It has been known in London since 1989 (two 10-km squares) and I think it is probably spreading. My own records include sightings in the churchyard of All Hallows by the Tower, Cable Street, the Grand Union Canal in Limehouse and the Bethnal Green end of Victoria Park. I understand that Mark Spencer and David Bevan recently saw it near HMS *Belfast* in Southwark. The *New atlas* shows its presence in two 10-km squares elsewhere in mainland Britain but there are no recent records from W. Cornwall, E. Yorkshire or Glamorgan where it has been recorded in the past. Some *Solanum* species are difficult to identify but this one keys out easily in Stace (1997).

Native species extending their range

Rosebay willowherb *Chamerion angustifolium**, Plantlife's County Flower for London, was a rare upland species until the mid nineteenth century but is now found throughout Britain. Our member Geoffrey Kitchener, writing in the *New atlas*, suggests that its spread in mainland Britain may have been from an overseas source (Kitchener 2002: 418). It was certainly cultivated in gardens and may have been thrown out. As with Oxford ragwort, railways have been agents in its spread. It thrived in London after the Blitz in 1940 and Ted Lousley, another past president of the LNHS, wrote of how a single plant could produce 80,000 seeds in a season and its creeping rootstock could spread a further yard each year (Fitter and Lousley 1953). Roth (2001) quotes a New York newspaper reporter who, in 1944, wrote: 'London, paradoxically, is the gayest where she has been the most blitzed.' He said that rosebay willowherb, also known as fireweed, was the cause: 'It sweeps across this pockmarked city and turns what might have been scars into flaming beauty.' I spent some happy hours on bomb sites in Cripplegate in the mid 1950s finding elephant hawkmoth larvae on the quantities of rosebay.

Round-leaved crane's-bill *Geranium rotundifolium** is a native annual of hedgerows, dry roadside banks and wall tops but spreading to roadside verges, rubble heaps, railway ballast and waste ground. In London it is also a garden and street weed. I have not been able to find a reason for its marked increase since publication of the *Atlas of the British flora* (Perring and Walters 1962).

Though I have seen it growing in the garden of a house near Holland Park, I think of wood avens or herb bennet *Geum urbanum** as a plant of woodland or hedges. Is there anything about it, other than its Latin name, which makes it a plant of the city? (It was only after giving this Presidential Address that I read, or reread, Rodney Burton's comment that '*Geum urbanum* is not aptly named for the conditions of modern cities, being at best suburban' (Burton, 1983). I subsequently (in May 2006) found it to be a fairly common weed in inner-city Dublin where Jackson and Skeffington (1984) think it 'is a relict species' growing where formerly there was woodland.)

Early meadow-grass *Poa infirma** is a native grass which used to be thought of as a coastal species in south-west England but has spread eastwards with some rapidity. Is it really a new arrival or did we miss it in the past? It has been turning up in several parts of London in the last few years. I found it this year (2005) in Bow in early April but it would be better to look for it in March or even February. It looks like a weedy, slender version of *Poa annua*, annual meadow-grass.

Conclusion

My last plant illustrates the ever-changing nature of the flora of London. It is not a native but another recent arrival, narrow-leaved ragwort *Senecio inaequidens**, from South Africa. Stace (1997) described it as a 'rather frequent wool-alien in En[gland] and Sc[otland], now naturalised on a sandy beach in

E. Kent, perhaps soon to spread as in N. France'. He was right and it was doing it even as the second edition of his *New flora* was being published in 1997. After spreading to north Kent and south Essex it was soon being reported from London boroughs in the east and north. It reached Bow in Tower Hamlets in 2001.

There are lots of other plants I could have mentioned: the passion-flower *Passiflora caerulea* that grows out of the wall of the River Thames on the Isle of Dogs, the plantains *Plantago* spp., knotweeds *Polygonum* spp. and swine-cresses *Coronopus* spp. that seem to thrive on trampled ground, the flixweed *Descurania sophia* that grew where the farmers' markets were held behind Notting Hill Gate Station in the late 1990s. And where are all those other grasses I could have mentioned? And what about ferns? Well there is an answer to that last question — a display which our secretary, John Edgington, showed at the recent Exhibition Meeting of the Botanical Society of the British Isles and which he has kindly brought with him this evening. This depicts some of the species of ferns to be found growing on walls in inner London.

When I told one member of my intention to speak about weeds, by which I meant urban wild plants, she made the comment that you have to take your pleasure where you can. Botanically speaking, I agree. Since coming to live in the East End of London twenty-eight years ago and while working for most of that time in inner London boroughs, much of my botany has been of the urban variety. There is no shame in the study of urban botany but there can be some frustration especially as so many of the plants one encounters are relatively new arrivals that were not in readily accessible books in my younger days. All that changed in 1991 with the publication of Clive Stace's *New flora of the British Isles* and its second edition in 1997. Stace's *New flora* is designed to enable identification of plants that are found in the wild whether they are native or alien, have arrived accidentally or been planted; as Stace points out in his preface 'it is often not possible to know'.

I should add that for me membership of this Society, the Wild Flower Society and the Botanical Society of the British Isles brought me in touch with competent and helpful botanists such as David Bevan, Eric Clement, Rodney Burton and George Hounsome, all of whom have helped me identify some of those plants that puzzled me at first. I should like to thank them and particularly this evening to thank David, George and Rodney who have kindly lent me the slides you have been watching.

Many, probably most, of the wild plants of inner London are introductions, variously known as aliens or exotics. Bevan (2001) notes that 'introductions are more varied here than anywhere else in Britain'. Some are very recent arrivals and I should like to draw your attention to some work that Mark Spencer wants to do to improve the holdings of recent arrivals of alien plants in the British Herbarium at the Natural History Museum. (At this point the president congratulated Dr Spencer on his recent appointment as Curator of the British Herbarium and invited him to outline the project.)

Finally, I should like to put in a plea for a little less tidiness. Let's not worry that there are a few neglected, even untidy, corners in our city. Let's leave some wildness and keep its interesting weeds. I think Gerard Manley Hopkins (1844–1889) in his poem *Inversnaid* (Hopkins 1881) got it right when he wrote:

What would the world be, once bereft

Of wet and of wildness? Let them be left,

O let them be left, wildness and wet;

Long live the weeds and the wilderness yet.

So, I say, whatever their definition, **long live the weeds,** especially in London.

P.S. Whilst writing up this address for publication in *The London Naturalist* I came across a discussion of weeds by John Akeroyd, a chapter in the *Flora of inner Dublin*. Akeroyd (1984) writes, 'Weeds are perhaps best seen as opportunist plants that are able to move into — and thrive in — the disturbed or seriously modified habitats created by us. They are our "camp followers", exploiting the habitats in and around our fields and about our dwellings, and they will be with us as long as we till the soil, build and construct and allow the dereliction of unwanted land and buildings.' For anyone interested in learning more about the development of an urban flora I recommend the *Flora of inner Dublin* (Jackson and Skeffington 1984).

In my address I referred to Richard Mabey's *Street flowers*. I have since been reminded by David Bevan that he also wrote *The unofficial countryside* (Mabey 1973), another good read in which his subject is 'the natural history of city and suburbia, of all places where town meets country, where nature adapts itself to man's interference . . . a world of docks, reservoirs and canals; of roads and railways, bomb-sites and building sites and waste ground; allotments and gardens, rubbish tips, factory walls and all the odd corners of industrial Britain' to quote the dust wrapper blurb.

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Book review

The flora of walls and buildings in the Isle of Ely. R. M. Payne. 20 pp. including 4 colour plates, reprinted from the 2005 issue (No. 47) of *Nature in Cambridgeshire*, and available, preferably through an annual subscription, from The Herbarium, Department of Plant Sciences, Downing Street, Cambridge, CB2 3EA (Price £4.50).

Ron Payne, an honorary vice-president of the Society and one of our longest-standing members, has once again published the results of a meticulous piece of recent fieldwork. This is the latest in a series of useful publications covering the floras of various urban habitats. These have included *The flora of King's Lynn* (1995), *The flora of walls in west Norfolk*, (1998), *The flora of roofs* (2000) — reviewed *Lond. Nat.* **80**: 228, and *The flora of Ely* (2002) — reviewed *Lond. Nat.* **83**:106.

In the current survey he examined more than 750 sites in the Isle of Ely between 1999 and 2004, and recorded a total of 299 species of flowering plants and ferns. As in his previous studies, the author has analysed his data and come up with some interesting findings. For example, 31 per cent of the wall flora was non-native and originated largely from local gardens (*Scutellaria rubicunda* from Albania and Greece was one of the more unexpected such escapes). Perhaps predictably, *Buddleja davidii* was the most widespread wall plant (29.1 per cent of sites), together with *Taraxacum* agg. (28.8 per cent) and *Poa annua* (28.6 per cent). On roofs, however, *Buddleja davidii* fell to fourth place (15 per cent), well below the most frequent colonizers of such places in the Isle of Ely*: Saxifraga tridactylites* (23 per cent), and *Sedum acre* (19 per cent).

By way of contrast, the author also surveyed pillboxes and similar defensive structures dating from the Second World War. These were found in much more rural localities and, unsurprisingly, supported far fewer non-native plants (only 8 per cent).

Particular attention was paid to ferns and, as in the London area, much the most widespread was the male fern *Dryopteris filix-mas*. The very first record of rustyback *Ceterach officinalis* in the Isle of Ely was made during the course of the survey, and two plants of ribbon fern *Pteris cretica* were found behind a down-pipe on Wisbech church.

As with his previously published surveys, Ron Payne's careful attention to detail has resulted in a most valuable account of the flora of these essentially urban habitats in the Isle of Ely. It would be instructive to carry out a similar survey in parts of the London area and compare and contrast the results. What plant, for example, might take the place of *Saxifraga tridactylites* as our own most frequent roof dweller?

DAVID BEVAN

The bramble florula of Queen's Cottage Grounds, Kew through a century and a quarter

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Abstract

Queen's Cottage Grounds, a semi-natural partly wooded area of now 37 acres (15 hectares) at the south-west corner of the Royal Botanic Gardens, Kew has had the species composition of its large population of brambles, *Rubus* L. subgenus *Rubus* (Rosaceae), surveyed five times between 1874 and 2000 by specialists in this large, predominantly asexually reproducing group of shrubs. For a group of such a critical character to have been the subject of periodic audits on a single limited site over such a lengthy period seems to be exceptional. Though the frequency of the individual species has not been recorded consistently, the data are sufficient to show that marked increases or declines in some have occurred. No less surprisingly, a number of regionally common species, some of them present in the immediate vicinity, have apparently been absent all along.

Introduction

At least in Britain, fieldwork on the major critical groups of vascular plants has tended to take the form in the main of random collecting (in suitable habitats) over relatively large areas, a tendency which has greatly increased as botanists have so generally become car-borne. This has had the drawback that all or much of those areas is usually unfamiliar to the collectors and, taken together with the commonly brief duration of halts, that has worked against including in specimen documentation and/or published records a note of the *quantity* in which the individual entities met with were present. By contrast, concentrating on a single site and investigating that intensively and repeatedly seems to have become more and more the exception, at any rate as far as the elucidating of the brambles, *Rubus* L. subgenus *Rubus* is concerned, a critical group particularly appropriate for that mode of study by reason of consisting of deep-rooting shrubs which, once established, can persist in the same spot for as long as a century or more.

One of the exceptions is the long-continuing attention given to the partly cleared area of semi-natural woodland known as Queen's Cottage Grounds that forms today a more or less wild extension of 37 acres (15 hectares) at the south-west corner of the Royal Botanic Gardens, Kew, occupying most of the east central portion of the one-kilometre square TQ1776 of the National Grid. For long part of the estate of Richmond Lodge, the summer residence of successive kings and queens since James I at least, and for many years the site of a small menagerie, this and Kew Palace were excluded when the Royal Gardens at Kew were transferred in 1840 to Civil Service control and fully opened to the public. Though numerous ornamental trees and shrubs were planted during the decade following, thereafter the Grounds were allowed to deteriorate into a wilderness, in which condition about two thirds continued to be kept, in accordance with Queen Victoria's wishes (and at the urging of some

of Britain's leading naturalists), when eventually the area was donated to the Botanic Gardens in 1898. Thenceforward a policy of planting mostly native trees was initiated and the Grounds were left on the whole to revert to a semi-natural state (Desmond 1995). Though all through the twentieth century the public were not excluded, the area's comparative remoteness protected it from overmuch trampling and other interference, but sizeable stretches have nevertheless remained treeless and subject to colonization by invasive scrub.

A principal component of that scrub has predictably been brambles. Though to other than botanists those are nothing but a nuisance, floristically they are a source of opportunity. For as a result of a reproductive system of unexampled complexity they have come to form one of the largest groups of critical plants in the European flora, combining multitudinous diversity with multiple modes of dispersal. The normally asexual — to be more precise, apomictic — entities of which the group almost wholly seems to consist are at least in some cases capable of reverting to sexuality on occasions and of producing hybrids, some of those sufficiently fertile and successful in the wild to constitute new autonomous entities and perhaps sometimes hybridize in their turn. This advantageously dual mode of reproduction has enabled the group to avoid the evolutionary blind alley that is the fate of more orthodox apomicts (such as the hawkweeds and dandelions). It has also enabled it to populate the central belt of Europe, from Ireland to Poland, with such a profusion of recognizably distinct quasi-species that it has eventually come to be more or less generally accepted by specialists that it is practicable to privilege with a binomial only those that have achieved a range of at least regional dimensions. That still leaves about 300 in the British Isles bearing a name, about half of them seemingly endemic (Allen 2002); both of these figures, however, will undoubtedly edge up further as investigation becomes ever more thorough.

Because of the specialist expertise required to discriminate the various named entities the treatment of *Rubus* subgenus *Rubus* in both national and local floras commonly extends no further than the couple of names inherited from the classification of Linnaeus. It is only when the flora of a comparatively small and strictly delimited area, such as an estate or a parish, is selected for an exhaustive floristic listing that a group such as this tends to come in for at least a measure of critical attention and the assistance of one or more specialists is invoked.

Successive bramble surveys

Not surprisingly, an institution with a body of plant taxonomists ever on hand, some of them with a continuing interest in the wild flora or fauna of Britain alongside their professional preoccupation with tropical plants, has given rise to a lasting tradition among the staff of the Royal Botanic Gardens of keeping a running tally of what the Gardens happen to hold in those respects and of publishing periodic lists of records. Specialists from outside have contributed to this work as well.

By chance, as early in its existence as 1866 the scientific staff acquired a contemporary authority on British brambles in the person of J. G. Baker, who in that and the decade following collected examples of one or two that he encountered in the neighbourhood — though none apparently in the Gardens or in Queen's Cottage Grounds. Some of those he distributed through the Botanical Exchange Club, which he largely ran single-handed at that period, with the result that duplicate specimens were acquired by other institutions.

It was not until another keen field botanist, G. Nicholson, joined the gardening staff in 1873 that the wild flora of the Gardens began to attract systematic attention. Whereas Baker was required by the then director, J. D. Hooker, to confine himself exclusively to the taxonomic work on tropical plants for which he had been recruited (Allen 1986 : 75), it made no sense for Nicholson to be under such a restriction, for his speciality was dendrology and

the major part he consequently played in developing the Arboretum (Desmond and Hepper 1993, Desmond 1995) necessitated his frequenting in particular the less closely-tended parts of the Gardens. It would even have been reasonable for him to be granted regular access to Queen's Cottage Grounds as part of his official duties, in order to give dendrological advice on their upkeep. The Grounds at any rate were one of five areas separately identified as covered by him in the pioneer survey of the wild flora of the Gardens that he proceeded to carry out in 1874–5, the first two summers after his arrival, even though they were not officially part of the Gardens at that date.

In the resulting list published in the *Journal of Botany* (Nicholson 1875) no critical taxa were included. Nicholson had no expertise in those and had to turn to others who had, some of whom lived at a distance and all of whom in any case were liable to take their time. In the case of the brambles he was able to turn to Baker, who was in a position to return determined specimens with a minimum of delay; but though one of the four specimens of *Rubus* was collected in the second year of that survey, the others bear the dates 1878 and 1895. From this it rather looks as if, in the case of this group at least, the survey was considerably protracted. An alternative possibility is that some or most of the material he initially collected was rejected by Baker as inadequate for determination, requiring Nicholson to return for more in a later year. Doubtless at Baker's suggestion, some were even distributed through the Botanical Exchange Club with a view to obtaining further verdicts (for that seems the likeliest explanation for how two have ended up in the herbaria at Oxford University and the South London Botanical Institute respectively). Regrettably, Nicholson seems to have deposited hardly any of the bramble specimens in the Kew Herbarium but retained them in his long-term possession (for the rule forbidding the keeping of personal collections, for which the Royal Botanic Gardens was to become well known, had either not been brought in by that date or else applied only to the scientific staff and not to the gardeners). As a result, his later donating of his herbarium to Aberdeen University had the effect of removing some of the physical evidence of what that first survey turned up from ready availability to those who carried out subsequent ones.

The list of such bramble taxa as Nicholson eventually succeeded in obtaining names for — and it was a sadly short one — in the end appeared twenty-one years after his initial survey formally ended (Nicholson 1906). Some time in the intervening period he had been emboldened to send the collection to the new leading authority on the group in Britain, the Revd W. Moyle Rogers, and the list included the mostly rather shaky results of that. The greatly improved taxonomy that Rogers (1900) had by then introduced and embodied in a widely bought handbook had meanwhile injected renewal zeal into the collecting of the group by British field botanists in general. One of the more persistent of the new zealots, A. B. Jackson, after some disillusioning years reporting for a country newspaper, arrived at Kew in 1907 to take up a post on the Herbarium staff, bringing that specialist interest with him just as Baker had done forty years before. The very next summer, in collaboration with a more senior colleague, the orchidologist R. A. Rolfe, he proceeded to survey the Queen's Cottage Grounds brambles afresh, referring to Rogers such specimens as he could not put a name to with confidence himself. Most of that collecting took place one day in August, but a fortnight later the two apparently made a further foray into the Grounds in the company of a retired physician from Tunbridge Wells, E. G. Gilbert, who had recently decided to specialize in the group (only to do so singularly unsuccessfully, it has to be said). At least four specimens identifiable as collected on that occasion by Gilbert are in the extensive *Rubus* collection that was bought for the Kew herbarium after his death in 1915; three later ones, however, are labelled merely 'Kew Gardens' and presumably represent the fruits of further visits on his own to other areas

(only?). Jackson and Rolfe, on the other hand, carried their survey of the Grounds over into 1909 — and no doubt would have continued for further seasons had not Jackson left Kew for the Imperial Institute in South Kensington the following year. Their published list (Rolfe and Jackson 1909) represented a considerable advance on Nicholson's, reflecting Jackson's greater experience of collecting the group.

Two decades later, on a day on July 1929, the Grounds were worked a third time. This was by the Revd H. J. Riddelsdell, the successor to Rogers as the recognized authority on *Rubus* in Britain at that period. It is unclear how that visit came about, but Riddelsdell was collecting extensively on the Surrey commons in those years, on the evidence of his herbarium — now in the Natural History Museum, wherein the specimens he collected that day are to be found — and maybe it arose in that context. Unfortunately, his knowledge of the group had been acquired mostly in the West Country and he was manifestly rather at sea in the substantially different florula of the South-East.

That in 1963 a yet further *Rubus* specialist paid a visit to the Grounds is similarly known of only thanks to the concrete evidence left in the herbarium, in this case fifteen specimens in that at Kew, all but three of them undetermined by the collector. This was A. Neumann, an Austrian enthusiast renowned for his collecting tours of Western Europe by bicycle at that period, following a mode of subsistence of legendary frugality and resourcefulness (on this particular occasion he is said to have put up for the night under an arch of Kew Bridge).

Finally, on learning that a wholesale updating of the list of the wild flora and fauna of the Gardens was in hand on the initiative of a Dr T. A. Cope of the Herbarium staff, the present author took the opportunity to propose that a survey of the brambles be carried out afresh. To that end a day's collecting took place on 28 June 2000, an almost complete set of specimens of the taxa met with being collected in duplicate for Kew and the Natural History Museum. Some of the more interesting records resulting have been published in a revised list of the brambles of Surrey as a whole (Allen 2003).

Species recorded

In the list that follows the order and nomenclature are as in Kent (1992) and the international standard code letters for herbaria are those of Kent and Allen (1984). Entries for species for which all records are clearly erroneous or doubtfully correct are placed within square brackets. Records are grouped under the surveys they relate to, each of which has been assigned a Roman numeral indicating its date order:

I	Nicholson : 1874–5 et seq.
II	Rolfe and Jackson : 1908–9
III	Riddelsdell : 1929
IV	Neumann : 1963
V	Allen and Cope : 2000

Sect. *Rubus*

Ser. *Sylvatici*

[*R. macrophyllus* I. 'Abundant'. Name obviously used in its now long-obsolete aggregate sense, applied to almost any eglandular bramble with largish leaves. II. No bush 'which can be assigned to any form of that variable species, nor can we find a dried specimen'.]

[*R. oxyanchus* II. One of Gilbert's specimens from the Grounds is labelled *R. nemoralis,* a name then is use for the species now known as *R. oxyanchus,* a trans-Channel one mainly found round Bournemouth but extending to west Surrey and Wimbledon Common — so a credible member of the flora of the Grounds. However, two successive specialists have not found the material convincing.]

Ser. *Rhamnifolii*

R. cardiophyllus IV. Specimen without frequency details.

[*R. dumnoniensis* I. 'Here and there'. Could refer to the above, robust examples of which were sometimes once so determined, but no specimen has been located. II. The single bush recorded (near Isleworth Gate, according to the specimen label), conf. Rogers, proves to be *R. armipotens.* The true *R. dumnoniensis* is now known to be strongly western and virtually absent from the eastern half of England.]

R. polyanthemus I. 'Abundant'. II. 'Abundant. Probably the commonest of the Kew brambles.' Specimen in **K**. IV. Two specimens, without frequency details. V. Common at the most.

[*R. prolongatus* II. *R. hypoleucus,* listed as one of the species found, was the name mostly given at that period to this one; it was, however, shared by *R. adscitus,* to which the record presumably belongs in this instance.]

R. rhombifolius I. Unrecorded — though there are five separate gatherings of Baker's, between 1867 and 1878, in **K** and **CGE** from 'Kew' and places nearby, under various other names, suggesting that it was then frequent in the vicinity. II. A specimen from the Richmond end of the Grounds, det. Rogers as *R. carpinifolius,* is this. Rogers' *R. sciaphilus* determinations in at least one instance relate to a bramble observed 'in one or two places' that is this too. III. Specimen without frequency details. IV, V. Not found.

Ser. *Discolores*

R. anglocandicans I. The sole specimen of Nicholson's located of what he applied the name *R. macrophyllus* to is in **ABD**, collected in 1878 from the corner of the Grounds near Isleworth Ferry Gate. It is this East Midlands species, very unexpectedly. This and two other geographically anomalous finds are discussed together below.

R. armeniacus V. A few bushes of the cultivar 'Himalayan Giant', an increasingly common and aggressive escape from gardens in southern England since the Second World War. Unless eliminated, it may speedily overwhelm much of the existing ground vegetation.

R. armipotens I. Unrecorded — though there is an 1866 specimen of Baker's in **K** from nearby Kew Lane, labelled *R. thyrsoideus.* II. The 'few bushes' attributed to *R. godronii* also prove to have been this, as is the supposed specimen of *R. dumnoniensis* from near Isleworth Gate. III. The sole specimen collected on Riddelsdell's visit (also labelled *R. godronii*) came from a 'ditch by river, Kew Gardens', presumably outside Queen's Cottage Grounds (as specimens he collected in the latter are carefully so localized). IV. No specimen. V. Locally common — as to be expected in the case of a species common over south-east England.

R. hylophilus II. A second specimen det. Rogers as *R. carpinifolius,* in this case from the north entrance to the Grounds, is this. IV. Specimen without frequency details. V. One large patch and another solitary bush. A characteristic species of the Surrey heaths and commons.

Ser. *Vestiti*

R. adscitus II. 'In several spots' (det. Rogers as *R. hypoleucus,* specimen in K amended to this by Riddelsdell and others). III. Series of ten specimens without frequency details. IV. Specimens without details. V. Abundant.

R. vestitus I. Unrecorded. II. 'Here and there' (as *R. leucostachys,* the name then incorrectly applied for the most part in Britain to this common and distinctive species of mainly basic soils). But the specimen det. Rogers as probably a hybrid of this with *R. ulmifolius* has proved to be *R. armipotens.* III, IV, V. Not found.

Ser. *Mucronati*

R. mucronulatus II. (A specimen mentioned as sent to Rogers and hesitantly det. by him as a form of this has glabrous anthers and many long gland-tipped pricklets, so clearly cannot be that. At present unidentified, it is labelled as collected by the pinetum, so it came from well outside the Grounds.) IV. A correctly-named specimen undocumented further than locality. This even more anomalous find than *R. anglocandicans* is discussed together with that below.

Ser. *Micantes*

R. glareosus I. 'Very common in shady places' (as *R. rosaceus* var. *hystrix* and *R. pallidus*). Specimens in **K** and **OXF**. One collected much later, in 1895, now in **SLBI** and originally det. as *R. rosaceus* by Nicholson, was redetermined by Rogers as *R. hostilis* and then by W. C. R. Watson successively as *R. diversus, R. hystrix* and ?*R. pseudadenanthus,* but is also this — Nicholson was in effect right in the first place. II. 'Very common and characteristic'. Rogers amended his earlier determination of *R. pallidus* to his new name of *R. glareosus* for this bramble in 1912. Material of a supposed hybrid with *R. echinatus,* mentioned as having been referred to Rogers, has not been located. IV. Specimen without frequency details. V. Local only.

[*R. micans* II. A gathering taken for an unusual form of this (under the name it then bore, *R. anglosaxonicus*) was considered by Rogers to consist of portions from two different species, only the stems being in his opinion correctly named. This western species, however, seems to be very rare in Surrey, known for certain only from one spot on Wimbledon Common (Allen 2003) and on that ground alone the determination would be suspect. The gathering is preserved in **K** but despite consisting of three panicles and four stems — all of which in my opinion belong to one and the same entity — has defied confident identification. It may be merely luxuriant *R. rudis.*]

[*R. moylei* II. A specimen sent to Rogers (as *R. mucronatus* ?) was det. by him as 'nearer' *R. ericetorum,* the name by which he knew this common south-east England species, but 'rather peculiar and not in a very good condition'. It is clearly *R. sectiramus,* however. There is an undoubted specimen of *R. moylei* in **K** collected by Gilbert in 1910 (as *R. ericetorum*) from an area within the Gardens that he failed to specify, and a patch is to be found today on the river towpath at no great distance from the Grounds.]

Ser. *Anisacanthi*

R. leyanus V. One patch in plot 04.

Ser. *Radulae*

R. echinatus II. 'Fairly common'. Also collected in the Grounds by Gilbert. III. A panicle accidentally included by Riddelsdell in his series of what has proved to be *R. sectiramus.* IV, V. Not found.

R. flexuosus I. 'Common in shade'. Known then as *R. foliosus* in Britain, this is a very distinctive species, normally unmistakable. II. 'Only a few examples'. IV, V. Not found.

R. iodnephes I?, II. A bramble mentioned under the name *R. podophyllus* (a species now known not to be British) as found in 1908 — ' in one or two spots' according to the label of the one specimen taken — but left undetermined by Rogers proves to have been this rare endemic, hitherto known in Britain only from three commons elsewhere on the south-west fringes of London (Allen 2003). Rolfe and Jackson considered their plant identical with the specimen they found in **K** mentioned by Nicholson as determined for him by Rogers as *R. podophyllus* (or a form between that and what Rogers called *R. oigoclados*). I have been unable to locate that sheet, but they may well have been correct, for Rogers subsequently det. as *R. podophyllus* too a specimen of Jackson's, now in **BM**, from Sheen Common that is now known to be *R. iodnephes.* That Nicholson did collect this species elsewhere in 'the neighbourhood of Kew' in 1878 is attested by specimens in **BM** and **MANCH** (det. D.E.A.) that he distributed through the Botanical Exchange Club (as a var. of *R. mucronatus, fide* C. C. Babington). IV. Specimen (det. D.E.A.) without frequency details). V. Three isolated bushes (conf. Newton).

[*R. radula.* II. 'A few bushes', conf. Rogers. Perhaps correct, as there are rightly named specimens of Baker's from 'Kew' in 1866 (**OXF**, **MANCH**) and Kew Lane in 1867 (**CGE**), though one from Sandy Lane, Kew in 1867 in **K** is *R. sectiramus.* Suspiciously, however, there have been no records since.]

R. rudis I. 'In open places, not uncommon'. II. 'Common' — but 'abundant' according to a specimen label. IV. Specimen without frequency details. V. Abundant.

R. sectiramus II. A specimen collected: see under *R. moylei.* III. A specimen without frequency details, queried by Riddelsdell as a hybrid of *R. ericetorum* (i.e. *R. moylei*), was subsequently recognized by W. C. Barton as this widespread but then poorly-

known and yet-to-be described species of the London area and elsewhere in southern England. IV. Specimen (det. D.E.A.) without frequency details. V. Common.

Ser. *Hystrices*

R. dasyphyllus IV. Two specimens (det. D.E.A.) without frequency details. V. Not found.

'KEW 3'. Another, decidedly variable member of ser. *Hystrices* unknown to Newton or myself was found to be frequent in 2000. Though it does not feature in Neumann's collection (IV), a series of 1929 specimens of Riddelsdell's, initially queried as *R. pallidus* but later rejected by him as that, seem to be weak examples of the same bramble. It may be of relatively recent hybrid origin.

Sect. *Corylifolii*

R. britannicus IV. Specimen without frequency details. V. Abundant, including a specimen which may be a hybrid with *R. adscitus.*

R. tuberculatus V. One clump by the Larch Pond. (Two gatherings so named by Babington that Baker distributed from elsewhere in or near Kew, in **K** and **CGE** respectively, are neither of this species as it is understood today.)

Discussion

The twenty named taxa accepted as reliably on record constitute a surprisingly and strikingly diverse assemblage. For a start, several of the London area's commonest ones are either genuinely absent or so extremely scarce as to have entirely escaped notice yet. The most conspicuous of these absentees — an absence remarked upon both by Nicholson and by Rolfe and Jackson — is *R. ulmifolius,* the commonest bramble by far over most of England on all but strongly acid soils. Even if the Grounds were for long too densely wooded to enable a light-demanding species like this to gain a foothold, it must be more than sufficiently plentiful in the neighbourhood for frugivorous birds to have brought it in since. *R. surrejanus, R. cissburiensis* and *R. moylei* are three others that could be expected to be present, though the second two currently grow a very short bird's flight from the Grounds. Further species whose absences are difficult to account for are *R. lindleianus, R. platyacanthus, R. subinermoides, R. euryanthemus* and *R. rufescens.* Some of the nearer London commons hold large populations of others, such as *R. bakerianus* and *R. londinensis,* that might have been expected to spill across too.

Hardly less remarkable than those absences is the presence of two species with strongly western distributions in Britain. One of them, *R. adscitus,* is known from only two other sites in Surrey, both of them far from Kew (Allen 2003), and nowhere else in England north and east of Hampshire is there more than a very thin scatter of records for it. Yet the population in the Grounds has been present for a century at least and clearly increased greatly during that time — as this species is prone to do wherever is becomes established. *R. leyanus,* on the other hand, must be a recent arrival, for it is too conspicuous to have been overlooked. Strongly concentrated in south Wales, it appears to be in the process of slowly spreading out from there eastwards into southern England and westwards into southern Ireland, and recent single finds in Guernsey and the Cherbourg region suggest an incipient extension across the English Channel too. It may be that the close proximity of the River Thames provides Queen's Cottage Grounds with sufficiently frequent raised levels of the atmospheric moisture that at least *R. adscitus* seems to demand (as suggested by its anomalously local abundance just across the Channel in the woods of the Pas-de-Calais, regularly bathed in coastal mists). The presence of these two is additionally interesting in indicating that long-distance dispersal by frugivorous birds has been relatively more efficient at increasing the species diversity of the *Rubus* florula of the Grounds than dispersal from close at hand.

Despite the paucity of specimens preserved from the earliest survey, which has prevented the obscurity of the over-broad taxonomy of the group then in general use being penetrated as far as one could wish, the reasonably continuous picture provided by the other four makes it possible to discern some changes in population sizes that may be real and not the result of observer error. The most striking and curious of those is the seemingly huge, comparatively recent increase in *R. britannicus*. A common species of heathy open woodland in south-east England, this may have been a prime beneficiary of reduction in the tree cover. Conversely, that might explain the marked decrease in the shade-demanding *R. flexuosus* between the first two surveys, culminating in its apparent extinction by the mid twentieth century, a period during which by contrast the two open-ground species *R. rudis* and (perhaps) *R. armipotens* appear to have noticeably increased. Another species to have decreased greatly, but for no obvious reason, is the easily recognized *R. echinatus*: 'fairly common' at the time of the second survey, it was collected only by accident in the 1929 one and has not been found since. Also inexplicable is the apparent disappearance since 1929 of *R. rhombifolius*, a species of open heathy ground, on record from numerous Surrey commons and evidently not infrequent in the Kew area back in Baker's time. Because of the all-too-general failure of *Rubus* collectors to add a note on quantity to their herbarium labels, the fact that such sizeable swings in population size can occur in this group has tended to escape notice.

The presence in the list of two geographically anomalous species, the east Midlands (and north Belgian) *R. anglocandicans* and the very distinctive *R. mucronulatus*, a boreal species otherwise virtually unknown in the southern third of England or in the whole of Wales, calls for some final comment. The first was collected in 1878 but has never been recorded again, while the second, though the sole find in its case was as recent as 1963, is represented by a specimen without particulars deposited by a botanist since deceased. Apart from those two, there exists a specimen of a third species that comes into this category too, but in its case with a provenance no more specific than 'Kew Gardens' — and so requiring its omission from the Queen's Cottage Grounds list. Collected by Gilbert in 1910 on one of his visits subsequent to the Rolfe and Jackson survey, this was determined by him as *R. melanoxylon*, a name long since recognized as misapplied to any bramble know in Britain. It is in fact, and very obviously, *R. griffithianus* (conf. Newton), a species then known otherwise only from north-west Wales and the south end of the Pennines — though since 1990 a thin scatter of finds has been made much more widely.

One such anomaly might be swallowed, if with some difficulty, but three finds in so comparatively a limited area, albeit at widely different dates, cannot but arouse suspicion. All, as it happens, are species that Baker was particularly well-placed to bring back to Kew in a fresh state from *Rubus*-collecting sorties to those other parts of Britain — *R. mucronulatus*, for example, is widespread in his native North Riding, of which he compiled a flora — or receive from correspondents (such as the Bangor botanist whose original discrimination of *R. griffithianus* caused that species to be named after him), with gardener colleagues on hand ready to oblige him by burying a root or sowing a few seeds, to enable him to test the stability of the plants' characters or, more simply, have a ready source of material for exchange. That Baker followed such a practice is quite likely, for there is ample evidence in herbaria that his contemporary and fellow *Rubus* specialist, C. C. Babington, was using the University Botanic Garden at Cambridge in just such a way. Although in the absence of documentary proof this can be no more than surmise, it seems at any rate plausible grounds for regarding the Kew occurrences of these three species as more probably relics of past cultivation than arrivals by natural means from the respective distant areas concerned.

Acknowledgements

I am most grateful to Tom Cope for making the arrangements for my visit, acting as my guide in the field and providing a print-out of the *Rubus* section of the existing list of published records on the wild flora of the Gardens that has proved of great assistance. I am also indebted to Alan Newton for providing a second opinion on some of my determinations, to Ray Desmond for sharing with me his unrivalled knowledge of the history of the Royal Botanic Gardens, and to Jim McGregor, Herbarium Manager of Aberdeen University Department of Plant and Soil Science, for searching for *Rubus* specimens collected by Nicholson and for the loan of one of them.

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Book review

Mosses and liverworts. Ron Porley and Nick Hodgetts. New Naturalist 97, Collins, London. 2005. 495 pp. Softback, £25, ISBN 0 00 717400 4; hardback, £40, ISBN 0 00 22012 3.

The surprising thing about this handsome book is that mosses and liverworts have not appeared sooner in the New Naturalist series. However, it has certainly been worth the wait. The native vascular plant flora of this country may be relatively impoverished, but we have a satisfyingly rich bryophyte flora: the authors point out that the number of species in the British Isles represents more than 60 per cent of the total in Europe (and by comparison our vascular plant flora represents only 20 per cent of the European total). So it is good to have this comprehensive and readable account of the diversity and importance of these lowly and inconspicuous plants.

After an introduction covering their life cycle, systematics and biology, there are chapters on their evolutionary history and distribution. The main part of the book is devoted to a series of chapters on habitats, explaining the typical species found in each habitat, the physical attributes which allow them to adapt to different conditions, how they obtain nutrients, the ecological communities formed, and containing much interesting information on subjects such as succession, bark chemistry, weather conditions, sensitivity to pollution, etc.

The first of these habitat chapters, unusually but very appropriately, covers man-made habitats, and other habitats covered are woodland (epiphytes included here), heath and acid grassland, acid rocks, chalk and limestone, coastal, fresh water, bogs and mountains. Many of the bryophytes mentioned are illustrated with colour photographs which do full justice to their interest and variety, and provide a useful addition to the line drawings used in most text books. These habitat chapters in particular make one long to be out in the field searching for some of the species they describe and illustrate.

Interspersed among the chapters are potted biographies of some eminent bryologists, although I was disappointed that these did not include E. V. Watson, whose *British mosses and liverworts,* still available in its third edition, has served so many bryologists as an approachable introduction to bryophyte identification.

The book is written in clear non-technical language, and is a valuable addition to the New Naturalist series. I hope it will serve to introduce bryophytes to a wider audience, and encourage people to look out for these fascinating plants when they are out in the field.

MARY CLARE SHEAHAN

I would like to draw readers' attention to *The bryophyte flora of the Isles of Scilly,* by Jean A. Paton and David T. Holyoak. This 25-page A4 work was published by the Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS) in 2005 and is available from ERCCIS at Cornwall Wildlife Trust, Five Acres, Allet, Truro, Cornwall TR4 9DJ, for £7.50 post free, cheques payable to Cornwall Wildlife Trust.

Members of the LNHS who visit the Isles of Scilly will find this well-presented synopsis of the bryophyte flora to be a welcome addition to their holiday kit. The distribution of each species of liverworts, hornworts and mosses in the individual islands is summarized. There are extensive notes on some of the species, a comprehensive list of refrences, and, on the centre pages, eight exceptionally good colour photographs. Ed.

A preliminary molecular investigation to characterize and identify Fulham oaks, their progeny and related cultivars in London

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Summary

A PCR-based DNA sequence study provides hope for the development of a rapid identification tool to establish the identity of genuine Fulham oaks, a hybrid tree cultivar of particular significance to the capital. Preliminary work indicates that several trees identified as this cultivar may in fact be *Quercus* × *crenata* 'Lucombeana' *crispa,* and others are likely to represent second-generation Fulham oak seedlings. Further work is however clearly necessary to refine techniques to differentiate these putative F_2 plants.

Introduction

The history and precarious future of London's Fulham oaks *Quercus* × *crenata* Lam. 'Fulhamensis', a distinctive hybrid of the Turkey oak *Q. cerris* and cork oak *Q. suber* first raised in the 1760s, has been documented by Wiltshire (2004) and its particular attachment and significance to the capital brought to a wider audience. It is one of many natural and artificially raised hybrids of this parentage, some of which are particularly fine and horticulturally valuable trees that have been more widely planted in the past, of which the Lucombe oak *Q.* × *crenata* 'Lucombeana' is the best known. The distinctions between these similar hybrids are however not always clear-cut and are particularly problematic when plants are immature. Further complications arise from the fact that these trees although hybrid retain some fertility; progeny raised from them, 'bastard oaks', are not morphologically or genetically identical to the parent plant. Nurserymen in Victorian times would routinely raise these often extremely similar plants in the hope of developing improved cultivar strains and many of these have found their way into cultivation.

We are thus now left with a small, aging and ever decreasing population of potentially historically and culturally significant plants whose claim to attention is lessened by our inability categorically to identify them.

The advent of modern molecular techniques which can directly study the genome provides us with the opportunity to look again at such complex questions of identity where morphological characters alone have been unable to provide resolution. Because of their economic importance and landscape scale significance oaks have received and benefited from particular attention. Molecular studies have been used to elucidate hybridization and species boundaries and also their phylogeography, the geographic distributions of related genealogical lineages. Thus research using chloroplast DNA sequence information has elucidated the natural (and unnatural, human-assisted) colonization of northern Europe following the last glaciation and coincidentally has shown the broad extent of hybridity in these wind-pollinated trees

(Dumolin-Lapègue et al.1997). DNA fingerprinting techniques have also been employed to aid in the identification of cultivars; these include one study of particular relevance to the Fulham oak, that of Plovanich-Jones et al. (1999) which used Inter-Simple Sequence Repeats (ISSRs) to screen rapidly a range of *Q.* × *hispanica* (= *Q.* × *crenata*) samples with particular emphasis on the Lucombe oak to determine their identity and origins. Among their samples were three London trees provided by EW. Rather surprisingly these, that had *a priori* on morphological grounds been considered to be 'Lucombeana' *crispa* (raised from a Lucombe oak acorn in 1792), apparently showed identical banding patterns to material identified as 'Fulhamensis'. These are the 'magnificent trees' from West Ham Park and Chiswick House mentioned by Wiltshire (2004).

This apparently anomalous finding and the desire to establish which of the remaining trees could with some degree of certainty be confirmed as being derived by vegetative propagation from the original Fulham oak tree, or conversely be excluded as seed-raised F_2, or later seed-raised progeny, form the basis of this preliminary investigation.

FIGURE 1. The original tree in the Fulham nursery, 1 May 1837 (Loudon, *Arboretum et Fruticetum Britannicum* 1838, 7: 278b).

Materials and methods

A range of primers widely used in taxonomic and phylogenetic studies, amplifying regions of both the nuclear and plastidic genomes, were screened on a subset of the trees identified by Wiltshire (2004) along with a limited number of samples of related oak species and their hybrids. The DNA fragments generated were sequenced and aligned to see if useable levels of variation could be established within the sample set. It was established that most of the gene regions analysed were too conserved, i.e. no variation was detected between taxa. However, primers generated a fragment of *c.*500 base pairs in length for the Externally Transcribed Spacer (ETS) region of the Nuclear Ribosomal DNA that did show polymorphism which it was felt could be used to address the aims of this study.

Specimens from the original Fulham oak tree (Figure 1), collected in 1881 shortly before felling, are still preserved in the Herbarium at the Royal Botanic Gardens, Kew. A DNA sample was requested from this type material and was made available to the authors in March 2006. Fresh leaf material of a range of putative specimens of 'Fulhamensis' from London and from major arboreta elsewhere in the country was collected by EW between April 2004 and July 2005, along with selected representatives of other *Q.* × *crenata* cultivars, the morphologically similar *Q.* × *turneri* 'Pseudoturneri' (Wiltshire and Coombes 2001) and one of its parents, the English oak *Q. robur*.

FIGURE 2. Fulham oak, Abney Park, January 2004. *Photo: Elinor Wiltshire*

FIGURE 3. Fulham oak, Hurlingham Lodge, July 2002 (since felled). *Photo: Elinor Wiltshire*

FIGURE 4. Fulham oak, Hurlingham Park, March 2006. *Photo: Elinor Wiltshire*

FIGURE 5. Fulham oaks, Kennington Park, March 2006. *Photo: Elinor Wiltshire*

FIGURE 6. Fulham oak, Ladbroke Square Garden, April 2006. *Photo: Elinor Wiltshire*

FIGURE 7. Roehampton Fulham oak, 2002, a 'great tree of London'.
Photo: Elinor Wiltshire

FIGURE 8. Lucombe oak (south tree), West Ham Park, April 2006. *Photo: Elinor Wiltshire*

Location and description of trees sampled (collected as putative 'Fulhamensis')

Dimensions show height in metres and girth in centimetres at 1.5 m unless otherwise indicated.

Abney Park, London Borough of Hackney. The tree labelled 'Fulhamensis' (Figure 2), girth 240 cm (EW, 2004), by path in remnant of 'oak grove'. This site was established as a cemetery in 1840 and landscaped by Loddiges' nursery. Long overcrowded with burials and overgrown by vegetation, it is now a nature reserve in which some very old trees survive.

Cambridge Botanic Garden, Cambridge. Cultivated as *Q.* × *hispanica* 'Heterophylla'.

Chiswick House. Identified as 'Fulhamensis' by Plovanovich-Jones et al. (1999) but morphologically more similar to 'Lucombeana' *crispa*.

Clinton-Baker Pinetum, Bayfordbury, Hertfordshire. Tree VH-100 planted 1837.

Crystal Palace Park (established 1854). London Borough of Bromley. Tree on embankment near Fisherman's Gate, girth 330 cm (EW, 2004).

Hampstead Heath, Vale of Health, London Borough of Camden. First in line of oaks on slope below Jack Straw's Castle. Recorded in 1955 by Maynard Greville as 'Quercus lucombeana' 55 ft × 10 ft 8 in [18 x 325 cm]. 26.6 x 443 (Jeremy Wright, 2006).

Hampstead Heath, Vale of Health. Tree overlooking pond, 21 × 380 at 1.1 m (Owen Johnson, 2001). Probably part of landscaping after 1871, when the Heath was acquired for public use.

Hurlingham Club, London Borough of Hammersmith & Fulham. Tree 190 by mansion entrance.

Hurlingham Club. Tree 193 by mansion entrance.

Hurlingham Lodge. Tree in grounds of private residence, built 1856, at junction of Hurlingham Road/Broomhouse Lane. Specimen collected 2004 — regrettably this tree has since been felled (Figure 3).

Hurlingham Park. Tree by entrance from Broomhouse Lane. Girth 300 cm, forked at 5 metres (EW, 2002) (Figure 4).

Kennington Park, London Borough of Lambeth. Central tree in line of nine Fulham oaks, average size 13 × 214 (Owen Johnson, 2001), planted post-Second World War. This park was created in 1854 and was noted for Fulham oaks 'in most parts of the grounds, one side of a square containing about twenty-five of these trees, which average 30 feet in height' (Webster 1920) (Figure 5).

Kew, London Borough of Richmond. 'Fulhamensis' No.1969-16002, 16 × 198 (Owen Johnson, 2001)

Ladbroke Square Garden, London Borough of Kensington & Chelsea. Laid out mid nineteenth century and reserved for use by residents. The Fulham oak, girth 236 cm (EW, 2004), is near the centre of the Garden (Figure 6).

Roehampton, London Borough of Wandsworth. This Fulham oak, 25 × 380 (Owen Johnson, 2002) and designated a 'Great Tree of London', stands at the junction of Danebury Avenue and Tangley Grove on the Alton Estate (Figure 7).

Syon Park, London Borough of Hounslow. Tree 1251, 23.5 × 370 (Topher Martyn, 2004).

Syon Park. Tree 1247 south of lake, 26 × 370 (Topher Martyn, 2006).

Victoria Park, London Borough of Hackney. Tree facing Queen's Gate, girth 237 cm (EW, 2002). Perhaps planted to commemorate Queen Victoria's visit in 1873.

West Ham Park, London Borough of Newham, north tree. Identified as 'Fulhamensis' by Plovanich-Jones et al. (1999) but morphologically more similar to 'Lucombeana' *crispa*.

West Ham Park, south tree (Figure 8). Identified as 'Fulhamensis' by Plovanich-Jones et al. (1999) but morphologically more similar to 'Lucombeana' *crispa*.

Other cultivars and species sampled:

Kew, Royal Botanic Gardens (Acc. No. 1879-9502), as 'Lucombeana' *crispa*.

Kew, Royal Botanic Gardens (Acc. No. 15912), *Q.* × *turneri* 'Pseudoturneri'.

Stockwood Park, Luton, *Q. robur*.

DNA was extracted from the above and the ETS region was amplified and direct sequenced using the following methodology.

DNA was extracted from 100 mg of fresh or frozen leaf material using a variation on the hot CTAB method (Rogers and Bendich 1994).This involved taking 100 μl of the upper aqueous layer from the SEVAC extraction phase after centrifugation: cleaning and concentrating the DNA solution using a GFX PCR DNA purification kit (Amersham Biosciences) into 20 μl of water following the manufacturer's instructions. The DNA eluted from the GFX columns was quantified using a Nano-drop spectrophotometer (Labtech International Ltd). One-μl aliquots containing DNA in the concentration range of 30–300 ng/μl were added directly to standard 25 μl PCR reactions — 2.5mM MgCl2, 200μM dNTPs,1× PCR Buffer and 0.5U TAQ (Bioline) — containing 1 μM each of the primers which successfully amplified a 500 base pair fragment of the external transcribed spacer gene region (ETS). The ETS fragment was amplified using the primers ETS-9 5′-CAT GGG CGT GTG AGT GGT GA-3′ and ETS18S 5′-GAG CCA TTC GCA CTT TCA CAG-3′ (Wright et al. 2001).

Reactions were carried out using a Techgene Thermal Cycler (Techne, Cambridge). Programmed with the PCR protocol of an initial denaturation at 94°C (5 min); followed by 30 cycles of 94°C (40 sec), 50°C (40 sec) and 72°C (40 sec); with a final extension cycle of 72°C (5 min.). Successfully amplified fragments were confirmed by ethidium bromide stained gel electrophoresis of 4 μl aliquots of PCR reaction. The amplification products were purified and again quantified as above. 15 ng concentrations (3 ng/100 basepairs of expected fragment length) of cleaned PCR product were prepared for sequencing using Big Dye v1.1 chemistry (PE Biosystems). 1/8 volume sequence reactions were performed in 10 μl volumes using a Hybaid Omnigene Thermal Cycler programmed to perform 28 cycles: 10 secs of denaturation at 95°C, 10 secs of annealing at 50°C, 4 min of extension at 60°C. On completion excess dye-labelled nucleotides from the reactions were removed by ethanol/sodium acetate precipitation, the dried pellets were resuspended and run on an ABI 3730 DNA capillary sequencer (Applied Biosystems).

For each sample the amplified ETS gene region was sequenced in both the 5′–3′ and 3′–5′ direction. The complementary sequences were assembled, edited and aligned using the Lazergene software package (DNAstar). Tree dimensions shown indicate height in metres and girth in centimetres at 1.5 m unless otherwise stated.

Results and discussion

DNA from leaf material of the type of the Fulham oak only became available in March 2006. As we still await a sequence from the type specimen, i.e. unequivocal 'true' *Fulhamensis,* we are here obliged to use circumstantial evidence to identify the tree(s) with the greatest claim to be grafted descendants of the original upon which to base our definitive Fulham oak sequence profile for comparative purposes in this investigation. The oldest documented living specimen available for comparison was the Fulham oak in the Clinton-Baker arboretum at Bayfordbury, Hertford, planted in 1837. This we accordingly have regarded as most likely to represent the 'typical' *Fulhamensis* sequence.

The hyper-variable region of DNA sequenced, the ETS region, like the more widely used Internal Transcribed Spacer (ITS), is present as multiple copies within the plant's genome, but it is believed that rapid concerted evolution generally acts to homogenize these copies. The degree of homogeneity is the result of interplay between the rate of homogenization and the rate of new mutations. These rates clearly differ between different taxonomic groups, with somatic mutations more likely to accrue in long-lived organisms such as clonal

herbs or trees. F_1 hybrids such as the true Fulham oak will produce copies of sequences from both parents, as the genome investigated is biparentally inherited and these will be visualized as multiple bands. However, the alignment software will generally only score the major component present which could come from either parent. Where two or more bases exist at any position in nearly equal strength an ambiguity will be highlighted. This may differ between different individuals of the same parentage and may conceivably differ between different extractions from different parts of the same individual, although our expectation is that for a particular genetic individual that the sequences identified will be identical. The rapid homogenization process will mean that by the F_2, i.e. seedlings from Fulham oaks, that presence of divergent sequences will have lessened and there will be a reversion to the norm in one of the parental types. This should lead to a lessening of ambiguous calls by the sequencing software.

TABLE 1. Material successfully sequenced with proposed identity.

Tree location	**Collected as**	**Sequence type**
Abney Park (Tree 40)	*Fulhamensis*	F
Cambridge Botanic Garden	× *hispanica 'heterophylla'*	F
Chiswick House	*Fulhamensis*?	P-G3
Clinton-Baker Pinetum (VH100)	*Fulhamensis*	F
Crystal Palace Park (north-east)	*Fulhamensis*	F(E)
Hampstead Heath (pond)	*Fulhamensis*	F(B)
Hampstead Heath (slope)*	*Fulhamensis*	F(A)
Hurlingham Park	*Fulhamensis*	F
Hurlingham Club (Tree 190)*	*Fulhamensis* F_2?	F(F)
Hurlingham Club (Tree 193)*	*Fulhamensis* F_2?	F(D)
Hurlingham Lodge*	*Fulhamensis* F_2?	F
Kennington Park (mid tree)	*Fulhamensis*	F
Kew Gardens (1879-9502)	*Lucombeana 'crispa'*	P-G1
Kew Gardens (15912)	× *turneri 'pseudoturneri'*	T
Kew Gardens (1969-16002)	*Fulhamensis*	F(A)
Ladbroke Square Garden*	*Fulhamensis*	F
Roehampton	*Fulhamensis*	F
Stockwood Park, Luton	*robur*	R
Syon Park (1251)	*Fulhamensis*	F(D)
Syon Park (1247)	*Fulhamensis*	F(C)
Victoria Park	*Fulhamensis*	F(D)
West Ham Park (north tree)	*Fulhamensis*?	P-G1
West Ham Park (south tree)	*Fulhamensis*?	P-G2

Key to sequence type code:
F = *Fulhamensis*, variants with 1–3 base pair changes are identified in parentheses.
R =*robur*, T = × *turneri*. P–G 1-3 = Pseudo-gene variants (see text for discussion).

The majority of old London trees, including two from the environs of the original Fulham nursery (Hurlingham Park and Hurlingham Lodge) significantly share the same sequence (Table 1) as the oldest known putative 'Fulhamensis', that at Bayfordbury which gives additional support to our assignment of these trees to 'true' 'Fulhamensis'. In addition a tree in cultivation at Cambridge Botanic Garden labelled as *Q.* × *hispanica* 'Heterophylla' but which on morphological grounds Wiltshire considered may be a 'Fulhamensis' on the grounds of our sequence data would seem to be so.

Almost all of the other trees previously identified as 'Fulhamensis' by Wiltshire (2004), or subsequently located by her and considered to be of this cultivar, differed by between 1 and 2 base pairs from this sequence, with four different single base changes recorded (A–D) and one 2 base pair change (E). A further tree at the Hurlingham Club (190), which had previously been tentatively suggested to be a seedling from a Fulham oak, showed a sequence which differed by 3 base pair changes (F).

Four samples produced different sequences that diverged massively (up to *c.*40 per cent) from the norm, to the point of being virtually unalignable (labelled P-G1-3 in Table 1). Given that sequence divergence between different *Quercus* species was of the order of *c.*5 per cent, it seems likely that for these samples we have sequenced a pseudo-gene (non-functional copy) of the ETS region. It is therefore difficult to draw definite conclusions as to the identity of these samples. It is interesting that the northern tree from West Ham Park was identical in sequence (P-G1 in Table 1) to the Kew plant identified as 'Lucombeana' subvar. *crispa* (Acc. No. 1879-9502). As Wiltshire (2004) notes, this Lucombe F_2 is morphologically the closest to 'Fulhamensis'. It is also perhaps significant that all of those samples which failed to amplify a typical *Quercus* ETS sequence are those remarkable trees identified as 'Fulhamensis' in the Plovanich-Jones et al. (1999) study but for which morphological characters indicate a different identity. Further work is clearly needed here but there must now exist considerable grounds for caution before accepting these trees as true Fulham oaks.

For the following trees, believed on morphological and historical grounds to be true Fulham oaks, unfortunately the initial extraction failed, re-extraction has been attempted and identity confirmation is awaited:

Abney (larger). 19 × 295 (Owen Johnson, 2003). Tree near that labelled 'Fulhamensis'.

Ashburton Park, London Borough of Croydon. Tree 14 × 352 at 0.7 m (Owen Johnson, 2001).

Regent's Park, London Borough of Camden. Forked Fulham oak, 16 × 324 at 0.7 m (Owen Johnson, 2001) near the site of St Katharine's Lodge (destroyed by bombs in 1944). It was 'a giant specimen of the Fulham oak, with a trunk girth of seven and a half feet at a yard up and a total height of 80 feet' — since then age, weather and probably war damage have taken their toll.

West Wickham, London Borough of Croydon. Another fine Fulham oak, 23 × 427 (Owen Johnson, 2003) on grass verge of Wickham Road.

It should be noted that with the exception of the tree from Kennington, all specimens tested were from trees well over a hundred years old — reflecting the fact that planting of Fulham oaks in London virtually ceased for a century. There has been a slight revival during recent decades, but it is not known whether the authenticity of young trees is standardized.

With what confidence can we treat the sequence results? There are several explanations that we must consider before reaching definite conclusions as to the identities of these plants; these include potential experimental errors and methodological shortcomings, as well as factors acting on the genome. In the former case TAQ error during PCR could result in incorrect sequencing.

Abramson (1995) however, suggests that error rates are generally in the order of 0.06–0.006 per cent per hundred base pairs, i.e. rather less than the one or more base pair differences we observe for the size of region we are investigating. We must also consider that because of the high copy number of the selected region, multiple sequences are present and these pose difficulties when scoring the products of the PCR reactions. If the different sequences occur in similar quantity it may be somewhat arbitrary as to which base present at a particular position is referred to as the major peak. The difference is thus perhaps more subtle than the apparent base change suggests. We must finally also consider that oaks are very long-lived organisms. Random mutations may occur over time, even within the same individual such that parts of a single tree may differ from each other. No replication or resampling was attempted for this preliminary exercise so it is impossible to gauge to what extent such somatic mutation may exist in these trees. The presence of the same base pair change(s) in several different individuals, some quite widely geographically spaced, suggests either that these trees are seedlings, or that if a mutation to a true Fulham oak has occurred that this has then been propagated, and indicates a closer kinship/linkage of these particular trees.

For those eight trees showing an identical novel sequence in this study we can be most confident that they are true 'Fulhamensis'. We can be less certain about the eight which differ by a single apparent base change, or even those two trees differing by two or three changes, for the reasons outlined above. Further work using a wider range of primers and other techniques will be necessary to resolve the question as to their identity.

Conclusion

DNA sequence information has the potential to resolve the identity of separate hybrids of the same parental constitution and may be further capable of distinguishing F_2 generations from these if the appropriate hypervariable genomic regions are used. However, developing a multigene approach alongside further work to establish the rate of mutation within individual trees may be necessary to achieve satisfactory resolution. Molecular evidence suggests that many of the trees identified by Wiltshire (2004) are almost certainly unequivocally true Fulham oaks. An almost equal number of trees differ very subtly at the sequence level and most likely represent Fulham oak seedlings, some of which have then themselves been vegetatively propagated. However, we cannot definitely exclude the possibility that they too are true Fulham oaks. A further four trees which have proven contentious in their identification continue to cause problems, but the balance of evidence suggests that they probably represent the products of a different hybridization event/events.

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Book review

The gilded canopy: botanical ceiling panels of the Natural History Museum. Sandra Knapp and Bob Press. Natural History Museum. London. 2005. Hardback with colour dustjacket. 168 pp., numerous colour illustrations £15. ISBN 0 565 09198 0.

The ceiling panels in the Central Hall, on the landings and in the North Hall of the Natural History Museum are an essential and highly decorative part of Waterhouse's mid-Victorian design for the building, yet they are hardly noticed by many visitors. This delightful book allows a detailed examination of them without risk of neck ache, and provides essential background both to the creation of the whole set and to each of the plants depicted. This leads up some familiar paths and others less familiar. The authors describe, I think for the first time, the complex way in which the drawings of plants from the Indian subcontinent can be related to the plates in Wallich's *Plantae asiaticae rariores*. In a similar way, a study of these panels has resulted in the creation of a beautiful book.

RODNEY BURTON

Ancient woodland indicator species and ecological change in two London woodlands

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Abstract

This study examines the factors that have affected the distribution of ancient woodland indicator species (AWIS) in two urban woodlands, Queen's Wood in north London, and Sydenham Hill Wood in south London.

Introduction

This study was carried out in two London oak-hornbeam woodlands — Queen's Wood in north London and Sydenham Hill Wood in south London — which are comparable in a number of respects (Table 1). Both contain areas considered to be ancient woodland.* The distribution of ancient woodland indicator species (AWIS), as defined in Rose's list for south-east England (Rose 1999, 2006), was mapped across specific internal boundaries in each wood. Historical narratives and recent historical research provide the context for the survey and show how changing land use and urbanization affected woodland in the London area, especially since the second half of the nineteenth century. Ordnance Survey maps give more-detailed evidence of woodland extent, and changes in boundaries and the surrounding landscape.

Despite the pressures imposed in the nineteenth and twentieth centuries by the construction of roads, railways and houses and the pollution of air and soil, proportionately less ancient woodland was lost in the Greater London area than in many other counties. Furthermore, the levels of extinction in woodland flora have been relatively low compared with other habitats. Preston (2000) shows woodland extinctions in Middlesex and Cambridgeshire as the lowest for any habitat type. Kent (1975) records that in Middlesex, only five woodland species were lost before 1970 (two between 1869 and 1890 and three between 1891 and 1910).

The main problem has been the progressive thinning of many flora and fauna populations and the increasing isolation of sites. Reviewing the reasons for the marked decline in the frequency of species in various habitats, Kent notes that declines might be attributed to factors including drainage, gravel digging, building, atmospheric pollution and possibly also microclimatic changes. Public access to woodlands brought new problems, primarily trampling, compacting of soil, and, in the nineteenth and early twentieth centuries, wholesale removal of woodland plants for gardens. 'Many amateur gardeners . . . went forth into the woods and fields of the London countryside in search of roots . . . and ferns. The lily of the valley, formerly abundant on Hampstead Heath, was eradicated largely in this way, and by the middle of the nineteenth century even primroses had become quite scarce round London' (Fitter 1945: 97).

* In the UK 'ancient woodland' is defined as woodland established by 1600. Before that date there was little planting of woodland, so most of the woods existing in 1600 are likely to be much older, possibly 'primary' — that is, sites that have always been wooded. The term 'recent' is commonly used to describe woodland established after 1600 (Peterken 1993). However, to distinguish woodland of different ages, this article uses the term 'recent secondary' to describe woodland that is less than 100 years old; and 'old secondary' for woodland that is 100–400 years old.

TABLE 1. Queen's Wood and Sydenham Hill Wood — a comparison.

	Queen's Wood	**Sydenham Hill Wood**
Size	21 ha	9 ha
Grid references	Middle of site TQ 287 885	Middle of site TQ 344 726
Vice-County	Middlesex (vice-county 21)	Surrey (vice-county 17)
Location	London Borough of Haringey	London Borough of Southwark
Distance from Thames	8 kms	7.5 kms
Previous names	Sowwood, or Oldfall in the 17th/18th century; Churchyard Bottom Wood in the 19th century	Dulwich Wood/Old Ambrook Wood
Status	Listed in the Nature Conservancy Council's Inventory of Ancient Woodland (1984). Designated a Local Nature Reserve in November 1990. Listed together with Highgate Wood, as a Site of Metropolitan Importance for Nature Conservation. Managed by LB of Haringey	Listed in the Nature Conservancy Council's Inventory of Ancient Woodland (1984). Designated a Local Nature Reserve in 1990. Also a Site of Metropolitan Importance for Nature Conservation. Managed by the London Wildlife Trust
Woodland type	Oak *Quercus robur* /hornbeam	Oak *Quercus petraea* /hornbeam
Topography	Hilly	Hilly
Soils	London Clay/Claygate Beds	London Clay/Claygate Beds
Surrounding area	Separated from Highgate Wood to the west by a busy, but not very wide road. Surrounded by houses and gardens on the other three sides.	Borders directly on Dulwich Woods to the west; Sydenham Hill to the south-east; housing estate to the north-east.

The woods

Queen's Wood (formerly known successively as Sowwood and Churchyard Bottom Wood) was originally part of the Forest of Middlesex. From the thirteenth century onwards, this area formed part of the Bishop of London's estate. These lands were usually leased and, from the mid eighteenth century, formed part of the Earl of Mansfield's leasehold lands, which also included Highgate Wood and Ken Wood. Clearance of these extensive woodlands was well under way by the 1600s and proceeded rapidly in the following centuries (Silvertown 1978). Until the mid nineteenth century Churchyard Bottom Wood was managed as coppice with standards, possibly as one single compartment (Bevan 1992). Some evidence of this management regime remains in the present generation of trees, particularly coppiced hornbeams of roughly even age. Its commercial value as woodland was overtaken by its potential value as real estate for urban development in the building boom that followed the opening of the new railways and of Alexandra Palace in the mid nineteenth century.

Churchyard Bottom Wood and adjacent Highgate Wood were saved from development and preserved for the public. The latter, renamed Queen's Wood to commemorate Queen Victoria's Jubilee (Game 2000), was purchased from the Ecclesiastical Commissioners by the Hornsey Local Board, succeeded in 1965 by Haringey Council (Bevan 1992; Hornsey Historical Society 1983). Both woods became public spaces, but Queen's Wood was not subjected to the same intensity of 'parks' treatment given to Highgate Wood (Latimer 1984), though several non-native tree species have been planted, including Indian horse-chestnut *Aesculus indica*, silver maple *Acer saccharinum* and London plane *Platanus* × *hispanica*.

The boundaries of Queen's Wood were extended slightly during the seventeenth or eighteenth centuries. Maps and records indicate that the main part of the wood is ancient, with a small area of older secondary woodland separated from the ancient wood by a bank, which runs through the western side of the wood to its northern border. Lloyd (1888) speaks of evidence of a seventeenth-century 'plague pit' found on the western edge of the wood. Silvertown concludes: 'It seems safe to assume that the pit would have been dug on the waste and not in the woodland which was coppiced at the time . . . . Then the bank probably marked the edge of the wood until at least 1670.' The wood has not changed significantly in size since the nineteenth century. Lloyd gives the extent of Churchyard Bottom Wood as 51 acres, and currently Queen's Wood is 21ha (51.9 acres). However, houses and gardens were built around it until today it is surrounded on all sides. By 1916 a minor (but now tarmac) road had been cut through the middle of the wood (compare Figures 1 and 2). Currently, a limited amount of management is carried out by the voluntary Friends of Queen's Wood, and since the 1990s, the Borough of Haringey's Conservation Officer has initiated the cutting of coppices (in the early 1990s and in 2002) and control of holly *Ilex* spp.

Sydenham Hill Wood was once a section of Dulwich Wood. This in turn was a part of the Great North Wood which, until the eighteenth century, extended from Croydon across Sydenham towards Camberwell, on the northern edge of the county of Surrey. It had long been an area of 'sylvan wilds' (Thorne 1876). The wood was part of an area known as Dulwich Coppices — suggesting that coppicing had been practiced in the past, though there is limited evidence of coppicing in the present generation of trees. The area that is now Sydenham Hill Wood was seriously disturbed in the mid nineteenth century by the building of the high level railway to Crystal Palace in 1865. The railway sliced through Ambrook Wood, a section of Dulwich Wood considered to be ancient woodland. The strip to the east of the line now forms the ancient woodland compartments of Sydenham Hill Wood (compare Figures 3 and 4). Large building plots were offered for lease on Sydenham Hill, on the eastern edge of this wood, the upper part of which was incorporated into the gardens of the villas built on these plots (see Figure 3). Although many of the trees remained, the flora was significantly altered by the introduction of garden species. To the west, the strip of ancient woodland was bounded by the railway and its soil composition made more basic by the importation of limestone ballast with some granite and clinker (Broughton et al. 1998). After the Second World War, the houses were abandoned and demolished and the former gardens reverted to woodland. The railway was closed in 1954. The wood was again enlarged by the addition of this area of secondary woodland adjacent to Sydenham Hill. The wood remained unmanaged until it became a London Wildlife Trust reserve in the 1980s. As a consequence a number of introduced species became well established. A project manager has been employed since the 1980s, though with a modest budget. LWT volunteers work on the site up to six or seven days a month.

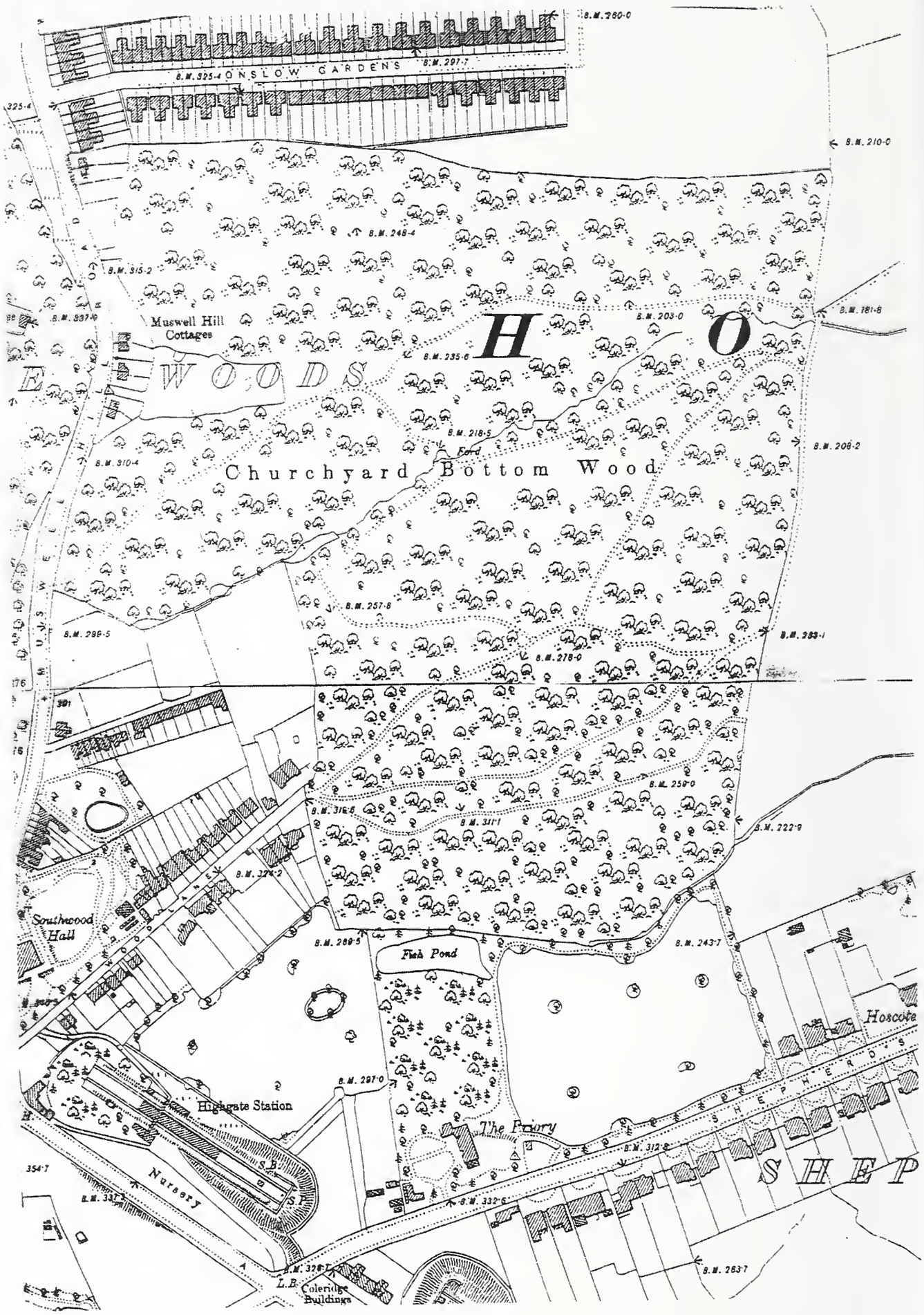


FIGURE 1. Churchyard Bottom Wood. Ordnance Survey 1:2500 edition of 1894–96, reproduced from London Sheet XL/Middlesex Sheet XII.5, showing the stream and 'strawberry field' (Old Ordnance Survey Maps, Highgate 1894/Muswell Hill 1894, The Godfrey Edition, Newcastle upon Tyne 1996).

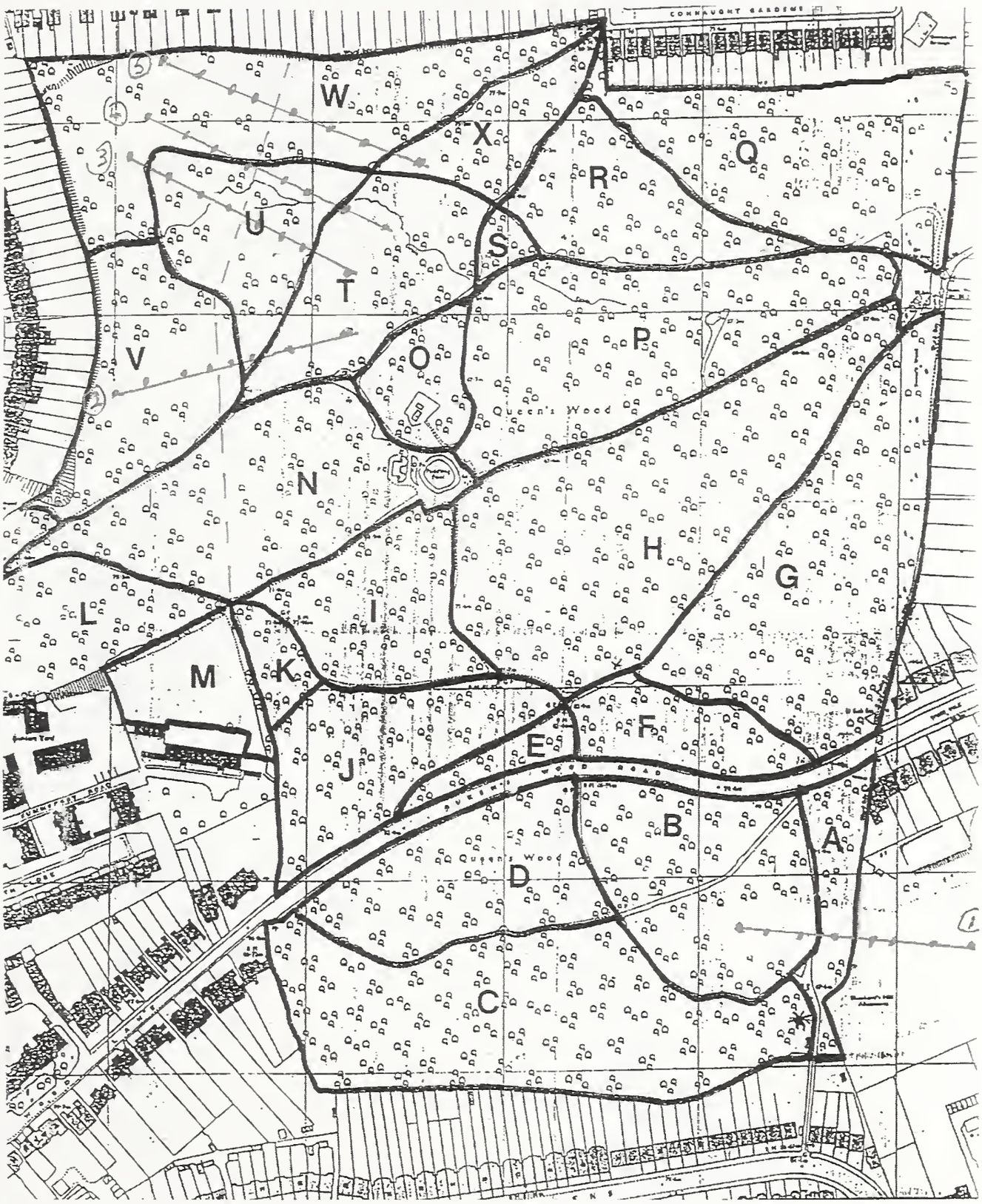


FIGURE 2. Queen's Wood compartments (Game 2000) showing the road through the wood, the drain, the wood bank and transects.

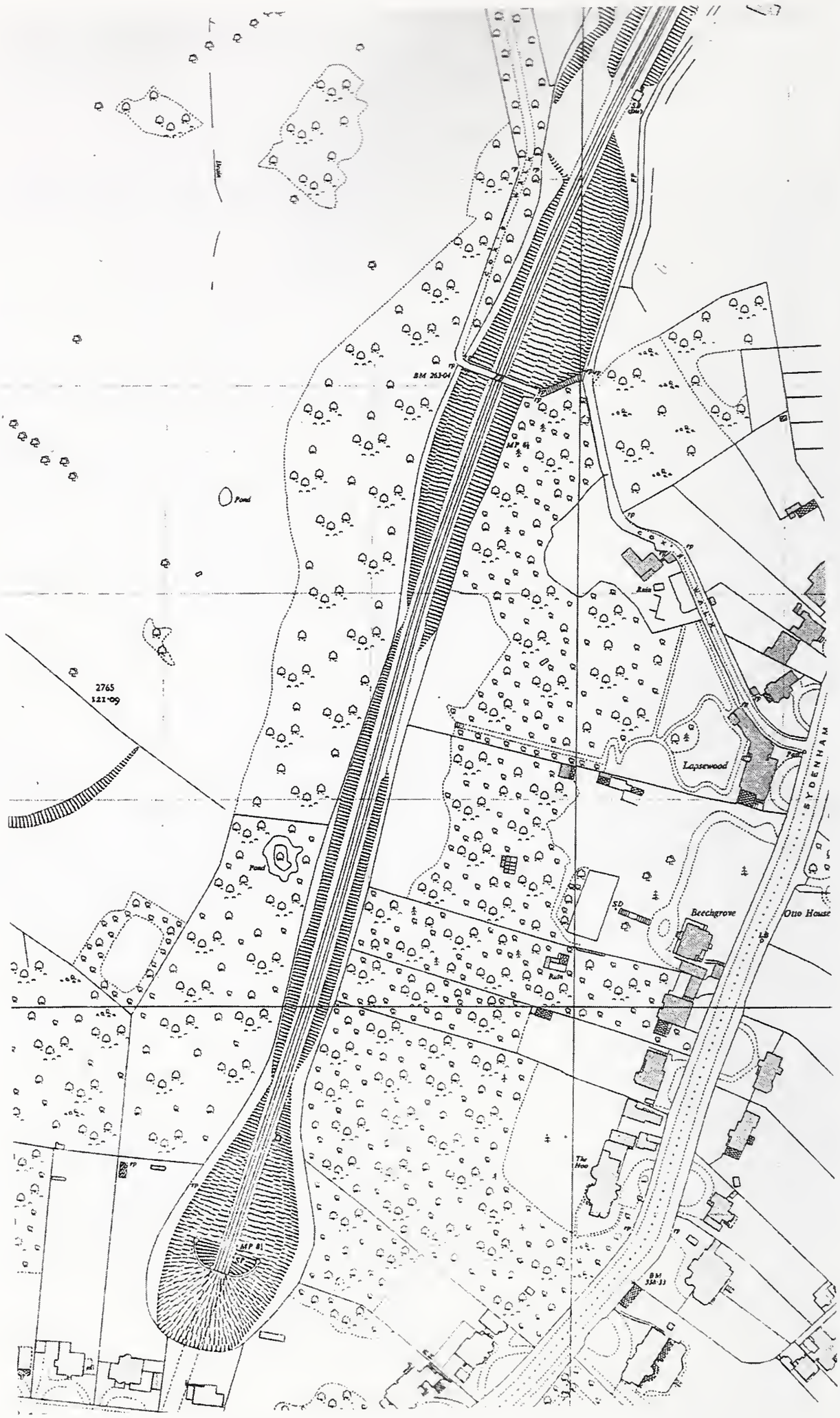


FIGURE 3. Sydenham Hill Wood. Ordnance Survey 1:2500 London, edition of 1951, showing the property known as the Hoo (see Lousley 1959). British Library microfiche.

Compartments

1. North end
2. Dulwich Wood borders
3. Railway trackbed
4. Old Ambrook Hill
5. Fernbank
6. Hazeldene
7. Old Wood north
8. Pond
9. Glade
10. Lapsewood slopes
11. Beech corner
12. Bluebell sanctuary
13. Lapsewood
14. Beechgrove

Produced by The London Wildlife Trust's Biological Recording Project

FIGURE 4. Sydenham Hill Wood management compartments (Broughton et al. 1998), showing the transects.

Survey method

A number of field surveys have examined the movement of AWIS across boundaries between ancient and recent woodland (Webster and Kirby 1988, Rackham 1975, and Gibson 1987 in the UK; and Bossuyt et al. 1999, Brunet et al. 2000, Dzwonko 2001 in Continental Europe). Most of these studies surveyed large areas of woodland in rural areas. This study adapted the methodology to a small-scale survey in urban woodland, to map the presence of invasive introduced species as well as AWIS. In each wood, five transects, each 96 metres in length, were placed perpendicular to the internal boundaries. They were located to include areas of the ancient woodland where AWIS had been identified in previous botanical surveys.

In Queen's Wood, transects were laid in two separate areas. Transect 1 was placed in the eastern section of the wood, where the ancient wood has a clear boundary with secondary woodland bordered by allotments. The latter area is not shown as woodland on the 1950 Ordnance Survey map and is therefore thought to be less than fifty years old. Transects 2 to 5 were placed at intervals across the wood bank referred to above, which forms a clear boundary (Figure 2). In Sydenham Hill Wood, transects 1 to 4 were placed across the boundary between compartment 4b — the ancient woodland area which formed the eastern part of the old Ambrook Wood — and compartment 5b, the secondary woodland where the former houses and gardens fronted onto Sydenham Hill. Transect 5 was placed across the boundary between compartment 7a, a fragment of disturbed ancient woodland, and recent secondary woodland in 7b (Figure 4). These boundaries are much less clearly defined than those in Queen's Wood. Although they exist on a site map, there is currently no means except perhaps Global Positioning Systems (GPS) to determine their position precisely. For the purposes of this survey, landmarks within the wood were used to position the transects across the boundary as accurately as possible.

AWIS were surveyed in eight 2-metre quadrats along each transect, a total of forty quadrats in each wood. The canopy and understorey were surveyed in 10-metre quadrats based on the same centre points as the 2-metre quadrats. This provided a picture of microhabitats in different parts of the woods and allowed analysis of the species composition of the canopy and understorey in the areas where AWIS were found.

Invasive introduced species (mostly woody species) were recorded in both 2-metre and 10-metre quadrats, to contribute to an understanding of competitive pressures in the ancient woodland areas. The invasive species were identified from recent botanical surveys:

sycamore *Acer pseudoplatanus*	Highclere holly *Ilex* × *altaclerensis*
spotted-laurel *Aucuba japonica*	Indian balsam *Impatiens glandulifera*
butterfly-bush *Buddleja davidii*	cherry laurel *Prunus laurocerasus*
Japanese knotweed *Fallopia japonica*	rhododendron *Rhododendron ponticum*

The Domin scale was used to estimate ground cover in the 2-metre quadrats and canopy/understorey cover in the 10-metre quadrats in order to indicate the extent of shading, bearing in mind that canopy cover can only be a rough guide to light flux patterns (Brunet et al. 2000). The aspect, slope, dryness/wetness of each 2-metre quadrat was noted, as well as nearby paths, streams and wet flushes. These details are important in analysing differences in the character of the ground flora between quadrats in the same transect, particularly in disturbed areas. Surveys were conducted in late April/May 2003 to identify vernal species. In July 2003, later flowering components of the ground flora were mapped using the same transects and quadrats. The spring survey of the ground flora (2-metre quadrats) was repeated in each wood in April/May 2005.

It is widely recognized that long-term monitoring — of up to twenty or more years duration — is needed for viable studies of continuity and change in

woodland ecology (Kirby and Morecroft 2000). In a couple of seasons, the most that can be obtained from a field survey is a snapshot of current conditions. In the absence of long-term surveys, the only way to achieve a longer perspective is to compare the results of the field survey with previous data on the flora and land use in the two woodlands. County and local floras dating from the late nineteenth and twentieth centuries were used in conjunction with recent botanical surveys to provide data on AWIS found in the woods over the past 150 years (Trimen and Dyer 1869, Kent 1975, 2000, Latimer 1984, Game 2000, Salmon 1863, Salmon 1931, Lousley 1958, 1959, 1976, Riley 2002).

Results

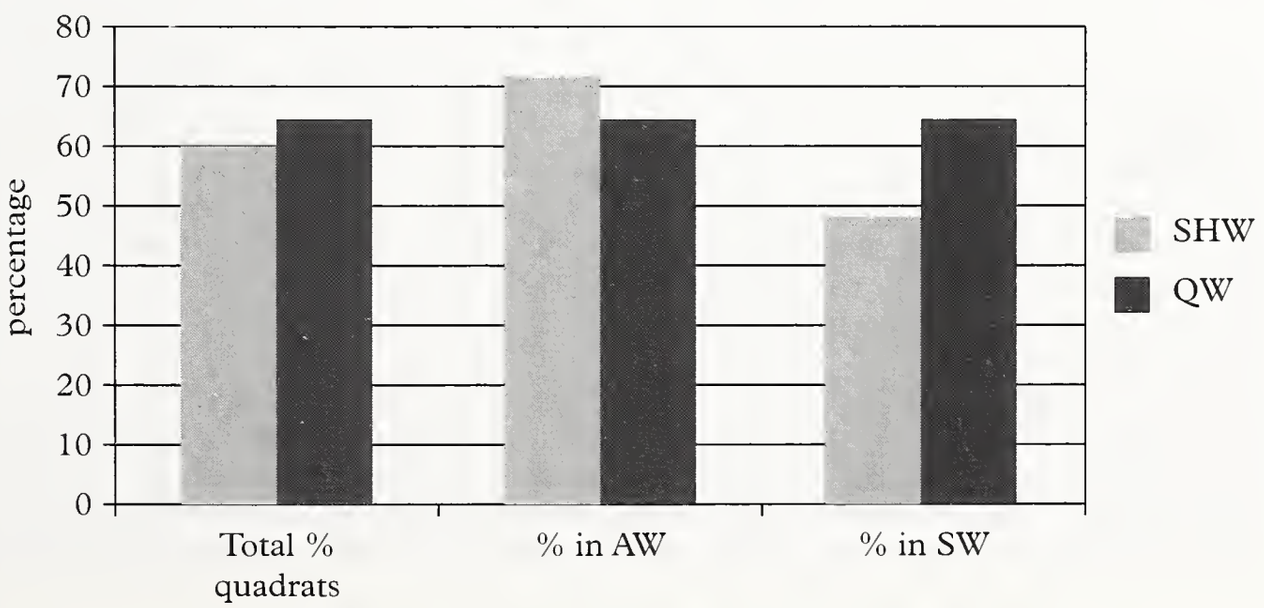
The field survey results must be tentative because of their small scale and limited time frame. Furthermore, the transects only reflect conditions in specific parts of each wood. This limitation is more important for Queen's Wood, which is more than twice the size of Sydenham Hill Wood.

Number of AWIS

The survey was not sufficiently extensive to provide reliable measures of abundance for each species, so the tabulation of results focuses on present/absence data. Only a relatively small proportion of the total AWIS present in each wood were identified in the forty quadrats surveyed. In Queen's Wood, the last full species list (Game 2000) shows fifty-one AWIS, compared with twelve found in this survey. In Sydenham Hill Wood, the last full vascular plant survey (Riley 2002) found thirty-three AWIS, while this survey found twelve (see Appendix). The total number of quadrats containing AWIS found in both ancient and secondary woodland was much the same for the two woods. However, the number of ancient woodland quadrats containing AWIS was higher for Sydenham Hill Wood and the number of secondary wood quadrats containing AWIS was markedly higher in Queen's Wood (Table 2).

TABLE 2. Proportion of quadrats containing ancient woodland indicator species: comparing Queen's Wood and Sydenham Hill Wood.

	Total quadrats containing AWIS (out of 40)		**Quadrats in ancient wood (AW) containing AWIS (total quadrats in AW)**		**Quadrats in secondary wood (SW) containing AWIS (total quadrats in SW)**	
	No.	%	No.	%	No.	%
Sydenham Hill Wood	24	60	14 (19)	73	10 (21)	48
Queen's Wood	26	65	13 (20)	65	13 (20)	65



Invasive introductions

The invasive species listed were found to be of greater significance in Sydenham Hill Wood because of the history of land use at the wood edge. In all but one of the transects, rhododendron and cherry laurel appeared to have spread into the ancient woodland from old plants in the former garden areas (recent secondary woodland). Sycamore was found in eleven out of nineteen of the ancient woodland 10-metre quadrats, both as saplings and full grown trees. In Queen's Wood, invasive introductions, though present, were much less prevalent than expected. Sycamore was only found in three ancient woodland quadrats. Similarly, cherry laurel saplings were found in three quadrats well inside the ancient wood but rhododendron was not found at all.

Highclere holly, a fully fertile bird-sown hybrid of garden origin, was found to be well established in both woods (Preston et al. 2002, Gilbert and Bevan 1997). It was found in six out of nineteen ancient woodland 10-metre quadrats in Sydenham Hill Wood, and seven out of twenty in Queen's Wood. Japanese knotweed was only found in two instances in sunny glades in Sydenham Hill Wood. It does not seem to tolerate the heavy shade in most parts of the old wood. In Queen's Wood, it is now confined to scrub land adjacent to the main wood, after some plants were removed from the coppiced area (David Bevan, pers. comm.).

Characteristics of the canopy and understorey

In Queen's Wood, the ancient woodland area has a more limited and consistent range of species. Hornbeam *Carpinus betulus* was the most common canopy tree, present in nineteen out of twenty ancient woodland quadrats. It was accompanied by pedunculate oak *Quercus robur* and the hybrid *Q.* × *rosacea* in fifteen of the ancient woodland quadrats. In the secondary woodland hornbeam was present in eighteen out of twenty quadrats, but pedunculate oak in only nine. It was evident that hornbeam was colonizing vigorously even in recently established woodland. Hollies *Ilex* spp. have a strong presence in this wood.

In Sydenham Hill Wood the range of species, both native and introduced, is wider. Sessile oak *Quercus petraea* was found in thirteen quadrats in the ancient wood and eight in the secondary wood, including several trees of considerable size (up to four metres dbh). This was a tentative identification — some were possibly hybrids. Ash *Fraxinus excelsior* was commonest in the southern section of the wood, creating a lighter canopy, though in eight of the ancient woodland quadrats this was counteracted by the presence of hollies *and* yew *Taxus baccata.* Elder *Sambucus nigra* was found frequently on path sides.

In both woods, there are quite extensive areas of bare ground or leaf litter, mainly due to heavy shade and/or trampling. Another possible influence on the success of ground flora in Sydenham Hill Wood was the prevalence of ivy *Hedera helix* spreading on the ground, found in thirty-six out of forty quadrats, in the ancient as well as the secondary wood. In Queen's Wood ivy only appeared in eighteen quadrats out of forty, mainly in secondary woodland.

Identifying AWIS

Hybridity in indicator species was a much more significant factor than had been anticipated. This created some uncertainties in the identification of individual AWIS, and may have influenced to some extent the results of the survey. Diagnostic tables of characteristics were drawn up to guide identification of hybrids (Rich and Jermy 1998, Sell and Murrell 1996, Stace 1997, Plantlife 2002).

The bluebells surveyed in these urban woodlands appeared to be predominantly *Hyacinthoides* × *massartiana,* the hybrid of the native English bluebell *H. non-scripta* and the Spanish bluebell *H. hispanica.* In Sydenham Hill Wood especially, only a few individual plants in the 2-metre quadrats could be definitively identified as *H. non-scripta.* Samples of flowers were taken from

several transects in each wood and perianth length and width were measured. They were compared with a sample identified as *H. non-scripta* from a woodland outside London. Those with the most '*non-scripta*' characteristics tended to have narrowest perianth width (*c.*3 mm), and to be altogether somewhat smaller. However, further study and a much larger sample would be needed to make a more accurate assessment.

Midland hawthorn *Crataegus laevigata* is easier to identify as long as the tree is in flower or fruiting. Where flowers were available, at least twenty specimens from each tree were examined to determine the number of styles. In at least two cases, leaf shape alone suggested that they were *C. laevigata* but the flowers examined had 1–2 styles, rather than 2–3, indicating that they were either the common hawthorn *C. monogyna* or hybrids. The latter is thought to predominate in London woodlands.

In Sydenham Hill Wood, sessile oak, an AWIS, is the dominant canopy species in the ancient wood area, which is unusual for south-east England, whereas pedunculate oak is dominant in Queen's Wood. In both woods, the hybrid *Quercus* × *rosacea* is also found. The two native species are very variable, and *Q.* × *rosacea* is also known to back cross with parent plants, so for the purposes of this survey, full identification was not possible. Saplings in the 2-metre quadrats were examined in detail and sessile oak saplings were recorded, but for large standard trees with few leaves accessible, identification could not be made with certainty.

The hollies *Ilex aquifolium* and *I.* × *altaclerensis* were present in both woods, including in the ancient woodland areas, though *I.* × *altaclerensis* had not been identified in the recent botanical survey of Sydenham Hill Wood. They were often found growing in close proximity. On *I.* × *altaclerensis*, all the spines face forward, some leaves are smooth-edged and not undulate as with *I. aquifolium.* However, as with other hybrids, there is a continuum of characters derived from the parent species.

Findings from historical floras and recent botanical surveys

The vice-counties of Middlesex (21) and Surrey (17) have been relatively well surveyed over the past century and a half. However, for specific sites, caution is needed in reaching conclusions, as the data are not always comparable. The exact locations in which specific plants were found is not always clear and in the recent surveys, different methodologies were used. Table 3 lists AWIS for which more than one historical reference was found, to give an idea of the changing and sometimes fluctuating fortunes of species in each wood. It is not possible to establish the abundance of particular species today compared with a hundred years ago, though it is notable that nineteenth and early twentieth century records already describe some AWIS as rare.

Queen's Wood

The key floras relating to Middlesex are Trimen and Dyer (1869), and two volumes of Douglas Kent's (1975, 2000) *The historical flora of Middlesex*. Earlier records include a hand list by Frederick Prickett (for a lecture delivered on 17 March 1848 to the Highgate Literary and Scientific Institution (in HLSI Archives — copy kindly provided by David Bevan) compiled from the records of James Petiver (1658–1718); and Camden's *Britannia* (1695), referring to the Hampstead and Highgate areas. More recent information comes from William Latimer's (1984) description of Queen's Wood (though this was not intended as a botanical survey) and from Meg Game's (2000) management brief, which includes a species list, supplemented and updated by David Bevan's observations. There appears to be considerable continuity in the indicator species ascribed to 'the woods around Highgate' going back to the end of the seventeenth century.

TABLE 3A. Queen's Wood — continuity and change in species found (AWIS for which more than one historical reference was found).

AWIS	Petiver early 1700s	Trimen & Dyer 1869	Kent 1975	Game 2000 & David Bevan's records/notes
Anemone nemorosa		Common	Locally plentiful in oak/hornbeam woods in N of vice-county, decreasing southwards. Queen's Wood (1900)	Present. In main wood and coppice
Blechnum spicant		Very rare	Very rare, declining in frequency, almost extinct. 'Wood near Highgate'. Herbarium of J.J. Dillenius 1700s	Present — single plant (compartment J)
Convallaria majalis	Present		Very rare and often non-flowering. Highgate (sic.) 1836/7	Present — one plant thought to be garden escape
Epipactis helleborine [Epipacris media]			Rare — mainly confined to northern parts of vice-county. Queen's Wood a single plant 1956 (E. B. Bangerter)	Present. Single plant 1990 (D. Bevan). Found again in some quantity in another area 2002 (Queen's Wood *Newsletter* Sept. 2002)
Hypericum androsaemum	Present	Very rare	Very rare, almost extinct. Between Highgate & Muswell Hill 1745	Present. Two plants widely separated, spreading more widely. Extinct as a native — very rarely bird-sown from gardens
Hypericum pulchrum	'in the woods about Hampstead and Highgate'	Rather common	Local and decreasing. Highgate 1830s	Small populations (David Bevan)
Lamiastrum galeobdolon		Rather rare	Locally plentiful in N of vice-county, v. rare elsewhere. Highgate Wood (Kent and Lousley 1951–7)	Present — ssp. *montanum*
Luzula sylvatica [Juncus sylvaticus]	'about Highgate'		Rare, mainly confined to acid soils. Between Highgate and Muswell Hill early 1800s	Present — one clump about 1 m square
Melampryum pratense		Rather rare. In wood on Muswell Hill, Highgate	Rare and confined to the N of vice-county. Queen's Wood 1963	Present in quantity in several places
Oxalis acetosella		Rather rare. Wood at Highgate	Local, confined to northern parts of vice-county. Queen's Wood 1956 (E. B. Bangerter)	Present by drainage ditch

TABLE 3B. Sydenham Hill Wood — continuity and change in species found (AWIS for which more than one historical reference was found).

AWIS	Salmon 1863	Salmon 1931	Lousley 1959 (The Hoo)	Lousley 1976	Riley 2002
Allium ursinum			Local	TQ 3472 frequent	Present in several compartments
Anemone nemorosa	Abundant in Surrey	Common in Surrey	Locally common	Common in Surrey	Present in several compartments
Convallaria majalis	In Dulwich Wood	'Despite raids made upon it' still plentiful, 'not uncommon in woods about Dulwich'. Curtis Fasc. V (1785)	Local, probably native, 'no hesitation in accepting the species as relics of the plants which Curtis in 1785 knew as 'not uncommon in woods about Dulwich'	'Certainly native in Dulwich woods'	Present in two compartments — possibly garden escape (one plant in poor condition — did not flower 2003)
Euphorbia amygdaloides	In Dulwich Wood				Not present
Hyacinthoides non-scripta (Endymion non-scriptus)	Common throughout Surrey	Very common	Locally abundant	Still common throughout country but decreasing rapidly due to trampling in places much used by the public	Present in several compartments but much less frequent than *H.* × *massartiana*
Ilex aquifolium	Frequent in all parts of Surrey		Frequent	Very common	
Oxalis acetosella	Plentiful in woods throughout Surrey		Rare		Rare (one compartment)
Polygonatum multiflorum			Rare, probably native — the smaller 'wild type'		Rare (possibly planted)
Quercus petraea			Dominant in the tree layer	TQ 3472 Best examples relics of Great North Wood on slopes below Crystal Palace: Low Cross, Peckamans and Ambrook Hill	Present in all compartments
Ruscus aculeatus			'perhaps native'		Present in one compartment

Sydenham Hill Wood

Floras of Surrey by J.D. Salmon (1863), C.E. Salmon (1931) and Lousley (1976) provide some information on AWIS in the area of Dulwich Wood, though direct references are quite sparse. A key source on Sydenham Hill Wood is Lousley's species lists (Lousley 1958, 1959) compiled following visits with Francis Rose to Dulwich Woods soon after the abandonment of the Victorian houses on the south-east of the site. They include a list of plants found in the woods to the east of the railway line in the area he calls 'the Hoo', referring to one of the properties which included part of Old Ambrook Wood. This area roughly conforms to the southern section of compartments 4b and 5b, which was included in this field survey (see Figure 4).

Discussion

The AWIS found in this study are not rare or unusual. The majority are vernal species that appear before the full canopy closes over. Oak/hornbeam woodlands are not particularly noted for the richness of their ground flora, and likewise woods on London Clay do not rank among the most prolific in AWIS. A recent survey in the Croydon area south of London showed the mean number of AWIS in woods on London Clay as 14.2, compared with over 20 on clay with flints, 19.7 for pebbles with sand, and 22.9 on chalk (McLauchlin and Fookes 2003). Historical research on the two woods showed considerable continuity in the species found over several hundred years, with only a few losses. The abundance of many species, especially the vernal ones, has probably declined significantly, but the scale of the decrease is very difficult to establish. The field surveys showed that many species have spread into the older areas of secondary woodland, and revealed several areas in each wood where 'assemblages' or 'guilds' remained among vernal AWIS, suggesting considerable resilience in face of numerous pressures.

The viability and dispersal ability of AWIS is influenced by a variety of factors including soil conditions, nutrient levels, the size and age of the woodland, light levels, water availability and, not least, by the dispersal characteristics of particular plants. How these factors interact to enable or inhibit specific AWIS to flourish and spread requires longer-term research. This discussion will attempt to identify the key factors that influence AWIS distribution and movement in these particular woodlands.

The larger scale studies cited earlier examine the propensity for AWIS to disperse into recent secondary woodland which had previously been used for agriculture or grazing. In small urban woodlands, the impact of factors in the surrounding landscape, and changing patterns of use, may also influence the conditions under which plants grow. Although the scale of this study limited its findings, the process of research and fieldwork raised a number of questions about the interactions between plant dynamics and landscape-scale processes affecting the current and future ecological status of these woodlands.

The distribution of AWIS in urban woodlands

To refine the results obtained, Peterken's (2000) ranking of AWIS from his research in Lincolnshire was used to distinguish those species that are the 'stronger' indicators of ancient woodland, defined as those which could grow in shade and had 55 per cent or more of their localities in ancient woods. These would also be least likely to colonize secondary woodland easily or rapidly. Using a list from a different region of the country — in this case Lincolnshire — could cause some distortions, but all the indicator species in this study that fit Peterken's list also appear in Rose's south-east England list. With these caveats, and in the absence of a list specifically drawn up for the London area, this was the closest approximation that could be achieved.

There was a notable difference in the distribution of the 'stronger' indicators between Queen's Wood and Sydenham Hill Wood (Table 4). In Queen's Wood the majority of quadrats containing 'stronger' indicators were outside the wood

TABLE 4. Ancient woodland indicator species: presence/absence in 2×2 m quadrats, ancient and secondary wood quadrats (aw/sw).

** Species identified in Peterken (2000) as 'stronger' indicators of ancient woodland.

Queen's Wood

AWIS	T1		T2		T3		T4		T5	
	aw	sw	aw	sw	aw	sw	aw	sw	aw	sw
Acer campestre			1							
** *Anemone nemorosa*	2		3	1		1	2	1		
** *Carex remota*						1				
** *Carex sylvatica*		1		1						
Carpinus betulus	1	2		2						2
** *Conopodium majus*							1			
** *Hyacinthoides non-scripta*						1				2
Ilex aquifolium	1	2	2	2	2			1	2	
** *Lamiastrum galeobdolon*						1				
Prunus avium			1					2		
** *Ranunculus auricomus*						1				
Ribes rubrum						1				

Sydenham Hill Wood

AWIS	T1		T2		T3		T4		T5	
	aw	sw	aw	sw	aw	sw	aw	sw	aw	sw
** *Allium ursinum*					2					
** *Anemone nemorosa*	1				1	1	2	1		
** *Carex remota*		1	1							
Carpinus betulus			1				1	2		
** *Hyacinthoides non-scripta*	1				1		2	1	1	
Ilex aquifolium	1		2	2	2	1	2	2		1
** *Lysamachia nemorum*	1									
** *Luzula pilosa*	1									
** *Oxalis acetosella*			1							
Polystichum setiferum		1								
Prunus avium					1				1	1
Quercus petraea						1	1			

bank in the old secondary woodland, particularly in Transects 3 and 5 (11 in secondary woodland compared with 8 in the ancient wood). Species included the wood anemone *Anemone nemorosa,* yellow archangel *Lamiastrum galeobdolon* and remote sedge *Carex remota.* Tutsan *Hypericum androsaemum* and wood-sorrel *Oxalis acetosella* were also noted in the vicinity of Transect 3. Some of the quadrats containing 'stronger' AWIS were located furthest from the ancient wood boundary. In two areas of recent secondary woodland — fifty to eighty years old (Transects 1 and 2*) — the only 'stronger' indicator found was wood sedge *Carex sylvatica.* On the other hand, the wild service tree *Sorbus torminalis,* which has a strong presence in Queen's Wood (though it was not found in this survey), seems to be confined to the ancient area within the wood bank. In Sydenham Hill Wood, where most of the secondary woodland surveyed is probably of a similar age (50–100 years), the number of quadrats with stronger indicators located outside the ancient wood was smaller (four compared with 15 in the ancient wood) and all but one were within 24 metres of the ancient wood boundary. However, the total number of 2-metre quadrats in the secondary woodland containing AWIS of all types almost equals the number found in Queen's Wood. Species included wood anemones, ramsons *Allium ursinum,* bluebells *Hyacinthoides non-scripta,* and soft shield-fern *Polystichum setiferum.*

There are particular problems with using these indicator lists in urban woodlands, which are often surrounded by gardens, parks and other improved grassland and wastelands as well as roads and buildings. For example, wood sedge, though included in Peterken's (2000) list, is often found in secondary woodlands, and in other habitats. There is evidence of the reintroduction of AWIS from gardens and waysides. Tutsan, thought to be extinct in Middlesex as a native, and noted by Fitter (1945) as common until the eighteenth and nineteenth century woodland clearances in north London, may have been bird-sown from gardens into Queen's Wood, where there are now a dozen or more plants (Bevan 1992). In the London area redcurrant *Ribes rubrum,* rare in the wild, is often bird-sown from garden plants (Kent 1975).

A further complication in tracing the movement of these slow-dispersing plants is the effect of past interventions in the woodlands, including the deliberate planting of AWIS. Much of the current secondary woodland in Sydenham Hill Wood had been covered by large gardens in the late Victorian era, when it was fashionable to create 'woodland gardens' in which gardeners were encouraged to plant native woodland species (Jekyll 1982). Spanish bluebells were also recommended for planting. Some AWIS found in this area may date from such interventions in the woodland. Sydenham Hill Wood has a number of fern species, including an AWIS, soft shield-fern, found in one of the 2-metre quadrats. These ferns are most common in the areas close to the former Victorian gardens, where they were popular species to plant. Therefore, although soft shield-fern is included in the count of AWIS, it could well have been planted (Matthews (2004) for a discussion of possible planting of ferns in Scratch Wood, north London). However, David Bevan (pers. comm. 2006) reports that this fern is now being found in numerous locations, for example in Coldfall Wood, and on the Parkland Walk in north London, as a result of long-distance spore dispersal from gardens and other established populations.

Garden cultivars can be confused with woodland AWIS, adding to the uncertainties created by deliberate planting. Yellow archangel was found in one of the 2-metre quadrats in Queen's Wood and was identified as *Lamiastrum galeobdolon* ssp. *montanum.* This is the AWIS, as distinct from the garden variety, ssp. *argentatum,* which has white blotches on its leaves throughout the year, and which grows on the northern border of Queen's Wood. A further step occurs when cultivars hybridize with AWIS. Recent botanical surveys and species lists note the presence of a number of hybrids of AWIS in both woods. However, the extent of hybridity among AWIS was not anticipated when planning the survey. This factor complicated the count of AWIS.

* In Transect 2, quadrats 5–8 lay in an area of recent woodland known as the 'strawberry field' (TQ 285 886) which, maps indicate, was not woodland until about eighty years ago (compare Figures 1 and 2). This area may previously have been used to cultivate fruit or vegetables, as the name suggests.

Influences on the dispersal habits of AWIS: the example of the wood anemone

The 'stronger' AWIS found most frequently in the surveys were wood anemones and bluebells. The wood anemone is described as an 'ecologically tolerant species' (Preston 2000), but is a particularly slow colonizer of secondary woodland. It is very slow-growing, with individual seedlings taking up to ten years to produce flowers. It spreads by a combination of clonal growth through rhizomes, and seeds, said to be dispersed by ants (Hermy et al. 1999). Seeds are not normally dispersed far from the parent plant. A maximum distance of 130 mm was reported in one study (Grime et al. 1988). The large clonal patches formed by the wood anemone are thought to be as long-lived as some trees and shrubs — a hundred years or more (Grime et al. 1988). However Brunet and von Oheimb (1998) point out that even when individual plants had colonized secondary woodland, the establishment of large patches comparable to those in ancient woods was a much slower process. In some cases further dispersal occurs when the young branches of the rhizomes break off, or when longer fragments of the rhizome disintegrate (Piroznikow 1994). A 1986 study in Essex woodland by Webster and Kirby (1988) plots the advance of AWIS from ancient woodland (Pledgdon Wood) into Lady Wood, which was about a hundred years old. Wood anemones were common in the ancient woodland but were still absent in Lady Wood. In contrast, oxlip *Primula elatior* (an AWIS in East Anglia — Rose (1999)) had spread rapidly into Lady Wood. The authors identified a combination of management, soil conditions and colonizing ability as factors explaining the difference.

The flowering period of the wood anemone ends as hornbeam comes into leaf, creating the heaviest shade of the deciduous tree species in these woods (Packham and Harding 1982). However, it was noticeable that wood anemones were often located by paths, streams and in glades, where overall light levels were somewhat higher. In the wood interior, low light levels throughout the year created by evergreen species may influence which wood anemone patches survive and flourish both in the ancient and secondary woods. The influence of light levels and hydrology will be discussed below.

The age of secondary woodland is also likely to be a factor in determining whether the wood anemone is able to establish itself. In both woodlands surveyed, it was found mostly in clumps, usually of 0.5–1 metre across, suggesting that, even in the secondary woodland, the plant was not newly arrived. The surveys also provided some limited data on the location of wood anemone patches in the secondary woodland quadrats — reaching up to 22 metres from the ancient woodland boundary in each case. In Queen's Wood, the patch furthest from the ancient woodland boundary was found together with yellow archangel and remote sedge on the edge of the drain. This area is likely to have been continuously wooded for several hundred years, which suggests that wood anemones had a long time to establish themselves. In Sydenham Hill Wood, the two patches found outside the ancient wood boundary are more difficult to explain. Possibly they were relicts of the ancient woodland prior to the 1860s, or they were planted. Another possibility is that there were intermediate patches, which have been destroyed by path formation, trampling and compacting of the soil. Finally, the ramets could have been moved. In Sweden and Poland, there is some evidence that wood anemone ramets are carried over long distances by wild boar and deer (Brunet and von Oheimb 1998), but it is unclear whether dogs could perform a similar function in urban woodlands. It is also possible that fragments of ramets could be carried some distance by rainwater runoff or in streams. This has occurred in Coldfall Wood in north London (David Bevan, pers. comm.).

Hybrids: the example of bluebells

The difficulty encountered in making a positive identification of the native English bluebell *Hyacinthoides non-scripta* is, as Stace (1997) notes, that the

hybrid 'is intermediate in all characters and fertile, forming a complete spectrum between the parents'. As a consequence, plants were found that had most of the characteristics of *H. non-scripta* with the exception of, for example, flower colour. Guidelines additional to those recently provided by Plantlife (2002) to identify *H. non-scripta* appeared necessary, and were gathered from several sources — in particular Rich and Jermy (1998) and Sell and Murrell (1996). Further research would be necessary to find out whether the plants that appear to have '*non-scripta*' characteristics are actually *H. non-scripta*. It is also possible they are simply manifestations of the extreme variability of the hybrid. If they are in fact pure *H. non-scripta*, a further question is whether they will continue to co-exist with the hybrid or will they, after a time, hybridize in their turn. It is also possible that gene exchange may not be accompanied by morphological change.

Hyacinthoides non-scripta is still present in both woods, but hybrid swarms of *H.* × *massartiana* appeared to predominate in the areas surveyed. In Queen's Wood, neither *H. non-scripta* nor *H.* × *massartiana* was found in the ancient wood quadrats, though this is not representative of their distribution in the ancient wood as a whole. In the secondary wood, *H. non-scripta* was found in two quadrats more than twenty yards from the wood bank, though large patches were dominated by *H.* × *massartiana*. In Sydenham Hill Wood, *H. non-scripta* was found mostly in the ancient woodland quadrats, especially in Transect 4, but in all cases the hybrid also appeared to be present.

Hyacinthoides non-scripta is thought to reproduce mainly by seed rather than by vegetative spread and is capable of forming large societies in oak/hornbeam woodlands (Blackman and Rutter 1954). However, there is considerable debate over whether the hybrid is making inroads on the *H. non-scripta* population. The view of Plantlife, that hybrids are threatening the native bluebell contrasts with that of Crawley (2005) who argues that there is no evidence of invasiveness or of gene flow hybridizing the native population. The Natural History Museum is conducting a further countrywide survey on the status of bluebell populations, and new work to compare the DNA of native, hybrid and 'Spanish' bluebells may provide greater clarity on these issues (Natural History Museum 2006).

External factors influencing AWIS distribution and dispersion

Other researchers have indicated the complexity of the factors that contribute to species richness in woodlands, particularly when focusing on AWIS (McLauchlin and Fookes 2003). The variables that seem most relevant in comparing these two woodlands are

- soil type
- the age of the particular patches of woodland
- the character of the canopy and understorey and resulting light levels
- the hydrology of the sites.

Soil type

Soil type is a basic factor in defining the number and type of AWIS found. The two woodlands are comparable in that they are predominantly on London Clay, with small areas of Claygate Beds, which characteristically has a low pH (in Sydenham Hill Wood 4.0–4.4, compared with 6.3 on weathered London Clay). In Sydenham Hill Wood there is an additional area of higher pH in the vicinity of the railway track bed where limestone ballast with alkaline and free-draining soils and grey slag gives a pH of 6.8–7.1 (G.S. Pettifer, communication to Ian Holt, Project Manager, Sydenham Hill Wood, April 2006).

Age of the woodland

The most species-rich quadrats in these surveys, whether containing AWIS or other woodland species, were not all found in ancient woodland.

Furthermore, several 'stronger' indicators of ancient woodland, including wood anemones, ramsons, bluebells and yellow archangel, were found in the older sections of secondary woodland, particularly in Queen's Wood. This seems to indicate that the flora of older secondary woodland, when adjacent to ancient woodland, is more likely to include AWIS, even slow-dispersing species such as wood anemones. There are differing views on whether the age of secondary woodland is generally a significant factor in the number and type of AWIS found. Bossuyt et al. (1999), using Spearman's rank correlation, concluded that there was a significant positive correlation between the age of secondary forest that was adjacent to ancient woodland, and the number and cover of AWIS. In this study, however, the sample was too small to conduct any comparable statistical analysis. In terms of indicator species, woodland that is 200–400 years old may well have an assemblage of species similar to that found in woodland that is more than 400 years old. On the other hand, the surveys found few stronger indicators in the most recent secondary woodland, suggesting that there may be a continuum influenced by age.

Changes in canopy and understorey

Changes in the management of these woodlands during the last 150 years have clearly influenced their architecture and ecology. Regular coppicing provided opportunities for the ground flora to flourish. The longer the interval between cuttings, the greater was the reduction in the ground flora, increasingly confined to path sides and the edges of glades (Salisbury 1916). Where coppicing has been reinstated in recent years, both the abundance and the diversity of the ground flora has increased, though this form of disturbance favours some species more than others (Barkham 1992). There have also been changes in the balance between native and introduced species in the canopy and understorey. This will have had differential impacts on the ground flora, probably favouring those which are shade tolerant. A heavy evergreen canopy or understorey that creates very low light levels all year round may also affect the survival and dispersal of vernal plants.

The competitive impact of the invasive introductions in the understorey was limited in Queen's Wood, where the main contributors to low light levels were native woodland species, primarily hollies *Ilex aquifolium,* combined with *I.* × *altaclerensis*. In Sydenham Hill Wood, the impact of invasive species was more significant. Rhododendron was found in fewer quadrats than cherry laurel but the placement of transects did not fully reflect the presence of these two species in the ancient woodland area. There is ongoing management work to remove new growth where this is possible without causing undue disturbance to other species. *I.* × *altaclerensis* and *I. aquifolium* as well as yew also created areas of very dense shade. For example, on a wood bank included in Transect 1, wood anemones, bluebells and wood-rush were present in a less shaded section but ten metres away, under a canopy of *I. aquifolium* and *I.* × *altaclerensis* there was only bare ground. Sycamore was found to be advancing into the ancient wood areas of Sydenham Hill Wood. However, in six of the 2-metre quadrats where 'stronger' AWIS were found, sycamore was also present in the canopy, suggesting that it was not inhibiting AWIS growth. The exception is its probable impact on the regeneration of sessile oak *Quercus petraea*.

Hydrology

In both woods, it was notable that the largest assemblages of AWIS were found near wet flushes and drains or small streams. Often these damper areas also had somewhat higher light levels, so it was difficult to separate the impact of the two factors. The hydrology of the woods was not a focus of this study, but the results suggest that it may play a significant part in the current location of AWIS, and warrants further investigation. In both woods, watercourses have been altered by the installation of artificial drainage during the past 150 years,

which may have affected the distribution of AWIS. Additionally, unpredictable effects are created by changes to road and pavement surfaces and therefore run-off and drainage in areas surrounding the woods.

In Queen's Wood, the stream that ran south-west to north-east through the wood in the nineteenth century dried up due to drainage and other factors. Some time between 1935 and 1950, a 'drain' was established further north, running roughly west to east (compare Figures 1 and 2). The dampness of this area was enhanced for a number of years by a leaking Thames Water pipe, which created a wet flush (David Bevan, pers. comm.). This was said to have been mended in 2001, but so far the most diverse damp woodland community among the north London woods remains intact, including goldilocks buttercups, wood sorrel, yellow archangel, square-stalked St John's-wort, wood sedge, remote sedge, and wood anemones (Bevan 1992). Part of this assemblage lies in the survey area and there are several other assemblages of woodland plants, including AWIS, on other sections of this drain.

The hydrology of Sydenham Hill Wood was dramatically altered in the 1860s by the rerouting of the Ambrook stream under the railway track bed and the installation of drainage systems in the Victorian properties on the south-east of the site. Recent changes have also been made in drainage from Sydenham Hill and adjacent roads (Pettifer 2004). In the survey area, a series of small wet flushes was identified as particularly rich in AWIS. It is likely that the headwaters of the Ambrook originally consisted of streamlets concentrating small, diffuse groundwater seepages from the more permeable sandy layers within the Claygate Beds, supplemented from time to time by direct surface runoff. Surviving seepages within the reserve feed these wet flushes, which support a distinctive flora (G.S. Pettifer, communication to Ian Holt, April 2006).

Conclusions

The survival of assemblages of AWIS in urban woodlands depends on a variety of factors, not all of which are controllable by management. Measures can be taken to contain invasive species, such as rhododendron, cherry laurel and sycamore. Studies on rhododendron suggest that attempts to eradicate it may be futile once it is well established, and risk causing severe disturbance and damage to other plants in ancient woodland areas. Containment, focusing on the control of new growth in ancient woodland areas is, however, an option (Rotherham 2001).

Protection of vulnerable assemblages of AWIS can be achieved by temporary or permanent fencing. However, in heavily used woods, new paths may be created around the edges of the 'reserved' area, causing further damage, especially if the species needing protection spreads beyond the boundary of the fence. In a small and well-used site like Sydenham Hill Wood a balance has to be struck between public access and the size of fenced-off areas.

Given the noticeable concentrations of AWIS and other species in the damper areas of both woods, it is probably also important to resist calls to improve drainage in these small woodlands, in order to preserve damp flushes, even if it means the occasional inconvenience of flooded paths. As noted, the dangers of the hybrid bluebell *Hyacinthoides* × *massartiana* hybridizing with *H. non-scripta* and thereby causing its decline are not proven. However, in small urban woodlands where the diversity and abundance of AWIS in general is under pressure, it seems worth monitoring native bluebell abundance while the issue remains in dispute. A decline in its abundance, whatever the cause, is not easily tackled by management, except by trying to ensure that colonies identified as *H. non-scripta* are monitored and protected. Damage to the leaves of this perennial can affect its ability to develop leaves and flowers in following years (Blackman and Rutter 1954). Therefore prevention of trampling is a particular priority.

The major uncertainty over the next century is how far climate change will alter the species composition of lowland deciduous woodlands in southern England and affect the viability of the assemblages of species that are now associated with ancient woodland (Kirby 2005). The exact shape of the changes is only beginning to emerge but given the interdependence and complex relations between species, both flora and fauna in woodlands may be affected. The spread of hybrids and introduced species is a problem if it occurs at the expense of AWIS and other scarce species, though this is not inevitable. This study does not address the role of the flora in providing feeding and nesting sites for birds, small mammals and particularly invertebrates, but another way of judging whether hybrids or introduced species are problematic is to look at how they fit or alternatively, disrupt these established relationships.

Most AWIS tend to be stress tolerant rather than competitive (Hermy et al. 1999), while some are 'intermediate' between the two extremes (Grime et al. 1988). They have adapted to their environments over many centuries and appear able to survive change, as long as it does not occur too rapidly. Some AWIS (for example, wood-rush and wood-sorrel) form long-lasting seed banks, which allow regeneration when conditions are more favourable. However, other key AWIS, such as wood anemones and bluebells, which do not form persistent seed banks (Grime et al. 1988) might be threatened by, for example, early spring bud-burst in woodland trees, increased summer drought and mild winters (Woodland Trust 2000, 2001).

Much is still unknown about how or why particular plants and communities of plants maintain themselves, colonize and respond to change. This suggests that greater attention should be given to a more detailed understanding of these woodlands, preferably through long-term surveys (London Biodiversity Partnership 2002). The complexity of woodland ecology and the impacts of unexpected events can complicate analysis even if long-term monitoring is in place (Peterken and Mountford 2005), but at the least, it would establish a baseline to understand changes that will inevitably occur as a result of climate change, shifts in species composition and the pressures of public use. No one factor can be identified as determining how ancient woodland communities can be sustained. It is unlikely that the 'ideal type' of ancient woodland delineated in the 1980s will remain in more than a few locations, and certainly not in small urban woodlands, which have to meet the demands of people as well as wildlife. The hope is that where the wider landscape provides a measure of protection in the form of buffer zones, woodlands such as these can be made resilient to change and retain the relatively high level of biodiversity in their flora and fauna that makes them valuable.

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Appendix follows:

APPENDIX

Ancient Woodland Indicator Species in Sydenham Hill Wood and Queen's Wood

AWIS in South East England (Rose 1999)	AWIS in Sydenham Hill Wood (from Riley 2002)	AWIS in Queen's Wood (from Game 2000 and David Bevan)
Acer campestre	*Acer campestre*	*Acer campestre*
Adoxa moschatellina		
Allium ursinum	*Allium ursinum*	*Allium ursinum*
Anagallis minima		
Anemone nemorosa	*Anemone nemorosa*	*Anemone nemorosa*
Aquilegia vulgaris		*Aquilegia vulgaris* (? Garden origin)
Blechnum spicant		*Blechnum spicant*
Bromopsis ramosa		
Calamagrostis epigejos		
Campanula trachelium		*Campanula trachelium*
Cardamine amara		
Carex laevigata		
Carex pallescens		
Carex pendula	*Carex pendula*	*Carex pendula*
Carex remota	*Carex remota*	*Carex remota*
Carex strigosa		*Carex strigosa* (discovered 2002)
Carex sylvatica	*Carex sylvatica*	*Carex sylvatica*
Carpinus betulus	*Carpinus betulus*	*Carpinus betulus*
Chrysosplenium oppositifolium		
Conopodium majus		*Conopodium majus*
Convallaria majalis	*Convallaria majalis* (?planted)	*Convallaria majalis* (?planted)
Crataegus laevigata	*Crataegus laevigata*	*Crataegus laevigata*
Daphne laureola		
Dipsacus pilosus		
Dryopteris aemula		
Dryopteris affinis		
Dryopteris carthusiana		
Elymus caninus (*Agropyron caninum*)		
Epipactis helleborine		*Epipactis helleborine*
Epipactis purpurata		
Equisetum sylvaticum		
Euphorbia amygdaloides		
Festuca gigantea	*Festuca gigantea*	*Festuca gigantea*
Frangula alnus		*Frangula alnus* (recorded by Silvertown in 1970s, not seen recently)
Galium odoratum		*Galium odoratum*
Helleborus viridis		
Holcus mollis	*Holcus mollis*	*Holcus mollis*
Hyacinthoides non-scripta (*Endymion non-scriptus*)	*Hyacinthoides non-scripta*	*Hyacinthoides non-scripta*
Hypericum androsaemum		*Hypericum androsaemum* (? bird sown from garden)
Hypericum pulchrum		*Hypericum pulchrum*
Ilex aquifolium	*Ilex aquifolium*	*Ilex aquifolium*
Iris foetidissima	*Iris foetidissima*	*Iris foetidissima* (? bird sown from local garden)
Lamiastrum galeobdolon (*Galeobdolon luteum*)		*Lamiastrum galeobdolon*
Lathraea squamaria		
Lathyrus linifolius (*montanus* – Rose)		

AWIS in South East England (Rose 1999)	**AWIS in Sydenham Hill Wood (from Riley 2002)**	**AWIS in Queen's Wood (from Game 2000 and David Bevan)**
Lathyrus sylvestris		
Luzula forsteri	*Luzula forsteri*	
Luzula pilosa	*Luzula pilosa*	*Luzula pilosa*
Luzula sylvatica	*Luzula sylvatica*	*Luzula sylvatica*
Lysimachia nemorum	*Lysimachia nemorum*	*Lysimachia nemorum*
Malus sylvestris		*Malus sylvestris*
Melampryum pratense		*Melampryum pratense*
Melica uniflora		*Melica uniflora*
Milium effusum	*Milium effusum*	
Moehringia trinervia		*Moehringia trinervia*
Narcissus pseudonarcissus		
Neottia nidus-avis		
Orchis mascula		
Orchis purpurea		
Oreopteris limbosperma		
Oxalis acetosella	*Oxalis acetosella*	*Oxalis acetosella*
Paris quadrifolia		
Phyllitis scolopendrium		*Phyllitis scolopendrium*
Pimpinella major		
Platanthera chlorantha		
Poa nemoralis	*Poa nemoralis*	*Poa nemoralis*
Polygonatum multiflorum	*Polygonatum multiflorum* (possibly hybrid)	
Polypodium vulgare (sensu lato)		
Polystichum aculeatum		
Polystichum setiferum	*Polystichum setiferum* (Found during this survey in 2003)	*Polystichum setiferum*
Populus tremula		
Potentilla sterilis	*Potentilla sterilis*	
Primula vulgaris	*Primula vulgaris*	*Primula vulgaris* (?planted)
Prunus avium	*Prunus avium*	*Prunus avium*
Quercus petraea	*Quercus petraea*	*Quercus petraea*
Radiola linoides		
Ranunculus auricomus		*Ranunculus auricomus*
Ribes nigrum		*Ribes nigrum*
Ribes rubrum	*Ribes rubrum*	*Ribes rubrum*
Rosa arvensis	*Rosa arvensis*	*Rosa arvensis*
Ruscus aculeatus	*Ruscus aculeatus*	
Sanicula europaea		*Sanicula europaea*
Scirpus sylvaticus		
Scutellaria minor		
Sedum telephium		
Serratula tinctoria		
Solidago virgaurea		*Solidago virgaurea* (planted)
Sorbus torminalis		*Sorbus torminalis*
Stachys officinalis		
Tamus communis	*Tamus communis*	*Tamus communis*
Tilia cordata		*Tilia cordata* (?planted)
Ulmus glabra	*Ulmus glabra*	
Vaccinium myrtillus		
Veronica montana		
Viburnum opulus	*Viburnum opulus*	*Viburnum opulus*
Vicia sepium		
Vicia sylvatica		
Viola palustris		
Viola reichenbachiana	*Viola reichenbachiana*	*Viola reichenbachiana*
Wahlenbergia hederacea		

Book review

Britain's orchids — a guide to the identification and ecology of the wild orchids of Britain and Ireland. David Lang. WILDGuides with English Nature, Old Basing, 2004. Hardback 192 pp., profusely illustrated with colour photographs. £15. ISBN 1 903657 06 7.

The core of this book is the fifty double spreads, one for each species, with text on the left facing photographs on the right, together with five more for subspecies of the most variable species. The text has all that is necessary on identification, habitat, pollination and conservation, and is accompanied by good detail on distribution, including a map which is basically a much reduced version of the map in the *New atlas of the British and Irish flora*, which is fine, except in the few maps with colour coding, e.g. to show early marsh-orchid subspecies, when the scale becomes impossibly small. The maps give only sites where the plant might still be present, so there is no dot for the dense-flowered orchid on the Isle of Man, and exclude the Channel Islands, so loose-flowered orchid appears only in the section on 'species of uncertain or doubtful provenance'. For the rarest species the distribution includes a potted history, but I am puzzled by the first British locality for the ghost orchid, on the 'Herefordshire–Wiltshire border'.

This book was published at about the same date as two others on British orchids. The others may have even more stunning photographs, but this one has the best text on conservation in action, and would be my recommendation to the flower-lover whose interest is not exclusively in orchids but would welcome a handy supplement on the family to the comprehensive floras. My only criticism of its content is that it could have done without scientific names, at a time when accepted English names are more constant, with the exception of those cases where there is a note about taxonomic status.

RODNEY BURTON

Changes in the flora of meadow grasslands on London Clay soils at Fryent Country Park

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Abstract

Hay meadows and associated grasslands on the London Clay soils at Fryent Country Park, London were monitored annually from 1985–2005. Notes are provided on over 200 species of plants recorded in the meadows and changes to the flora. Factors that affected the flora included the grassland communities present at the start of the investigation, land-use and grassland management, succession, ground disturbance, fly-tipping, introductions, and weather-related factors.

Introduction

Hay meadows are permanent grasslands that are cut, usually for hay and typically once annually. In some cases, a second hay cut is taken and /or there may be grazing of the aftermath by farm animals. In cases when it is not practical to undertake a harvest in any year, the material may be left on the ground or not cut. If the meadow is left uncut for a number of years, the grassland may succeed to rough grassland and later to scrub. Conversely, as cutting frequencies increase from three or more a year, so the grassland will resemble a mown grassland or lawn community.

Historically, as woodland was cleared from the Middlesex area, meadow land became established. On the London Clay soils these were often poorly drained, but subject to drying-out during the summer. As London spread northwards, particularly in the early decades of the twentieth century, much of this meadowland was lost to suburban and other development (Kent 1975). Grasslands and hay meadows have survived at a few locations, such as Fryent Country Park in the London Borough of Brent, where the meadows cover approximately sixty hectares. It is not necessarily an original example, since there is evidence that meadows were ploughed during the Second World War and in the late 1960s / early 1970s. However, references suggest that the fields had been farmed primarily as hay meadow and / or as grazed grasslands since at least the late sixteenth century (see All Souls College 1597; and Williams, Fowler and Jarvis 2000).

This paper describes the flora of the meadows, changes in the frequency of individual species; and makes reference to the factors that influence the flora.

Methods

Monitoring of the flora of the meadows was undertaken annually from 1985–2005. The method was described in detail by Williams, Fowler and Jarvis (2000). The essential features involved the use of ten (twenty in 1985) one-

metre square quadrats in each meadow. The number of meadows surveyed annually varied between sixteen and twenty-eight. Each meadow was divided approximately into ten sub-areas and a marker was thrown in each, avoiding atypical features. Quadrats were placed where the markers fell. Species were recorded as present if their foliage was partially or wholly within the quadrat area. Frequencies for species were taken as the percentage of quadrats in which a species was found, both within a meadow; and then averaged for all meadows surveyed. Species that were recorded in the meadow but not in a quadrat were given a nominal frequency of 1 per cent in the database: as were species recorded opportunistically at other times of the year, though for this, observer time on site reduced from the mid 1990s. Fieldwork was usually undertaken within the target dates of 15–30 June by teams from Brent Council Parks Service and Barn Hill Conservation Group. In total, data were taken from approximately 5,000 quadrats, to provide frequency records amongst a species × meadow × year database of over 100,000 presence/absence records. The total figure was inflated by inclusion of species of disturbed ground. Records were maintained of the meadow management.

Data from sixteen of the meadows for the years 1985–1996 were analysed by multivariate analysis (Williams, Fowler and Jarvis 2000). A Latin square investigation was established from 1989–1994 in Warrens/Blacklands field to investigate the influence of three types of grassland management; hay harvesting, flail cutting only, and no cutting, on the flora (Williams, Fowler and Jarvis 1999). Information was also available from a soil survey and other investigations.

FIGURE 1. Hay meadows at Fryent Country Park. Meadows referred to in the text are those with the reference letters A to Z, Aa and Ba. Other local place names are also indicated.

Fryent Country Park covers an area of over a hundred hectares about fifteen kilometres north-west of central London. It is surrounded by suburbia and bisected by the A4140 (Fryent Way). Formerly part of the Middlesex (v.c. 21) countryside, the Park is within the Northern Thames Basin Area (Countryside Commission and English Nature 1996). In altitude the meadows vary from about 40–65 metres above mean sea level. The Park is owned by Brent Council and managed with the assistance of the volunteers of Barn Hill Conservation Group. The Park is a Local Nature Reserve, Metropolitan Open Land, a Site of Metropolitan Importance for Nature Conservation; and the meadow produce is certified to the Soil Association Organic Standard.

The meadows included in the monitoring are those with reference letters in the series A to Ba in Figure 1 with the exception of Meade West (G) which was converted to a car park before monitoring commenced, and Upper Hydes East (D) which was landfilled and drained to create an events field. Some meadows on the west side of the Park were the subject of unauthorized vehicle access and fly-tipping from 1986–1990. Much of the fly-tipping was removed using mechanical bulldozers and other machinery, which left relatively large areas of disturbed and bare ground until the grasslands re-established. Meadows affected in particular were E, H, D, C and F. Following renovation and the occasional use of some meadows for public events, hay harvesting was largely discontinued in meadows D, E, F and H; and the monitoring in meadows E, F and H was suspended after 1995. The multivariate analysis used the data from the sixteen meadows L to Ba (excluding P) for the years 1985–1996. The Latin square investigation was undertaken in plots in meadow W.

Results

A soil analysis of the topsoil was undertaken in 2002 and found that for twenty-four meadows surveyed, the total nitrogen averaged at 0.62 per cent (m/m) within a range of 0.50–0.78 per cent (m/m). Phosphorus averaged 20.6 mg/l (range of 6–53 mg/l), potassium 182 mg/l (range of 113–306 mg/l) and magnesium 335 mg/l (range of 237–469 mg/l). The pH values were in the range of pH 5.2–7.5 with most between pH 6.0–7.0.

In the species accounts the order and names follow Smith (1980) and Stace (1997). Frequency data are not generally stated for species with low frequencies.

Mosses Bryophyta. The height of the hay meadow sward was not conducive to the growth of mosses and though formative moss plants may have been overlooked, mosses were uncommon in the meadows. There appeared to be more records during the earlier years of the investigation, which corresponded to a time when the sward canopy may have been more open. The identified mosses in the meadows were *Fissidens taxifolius*, *Funaria hygrometrica*, *Brachythecium rutabulum* and *Eurhynchium praelongum*. The *F. hygrometrica* was associated with disturbed ground following damage to the meadow sward.

Adder's-tongue *Ophioglossum vulgatum*. Little Hillcroach meadow was the receptor site for a rescue translocation in advance of land-filling and the construction of a golf-course car park at Northwick Park (TQ163874) a few kilometres to the west. The transplanting was undertaken in 1986 and the plants persisted until at least 1988 but were not found subsequently. Elsewhere at Fryent Country Park, two colonies of adder's-tongue occurred in old grassland at Saltcroft on the slopes of Barn Hill.

Meadow buttercup *Ranunculus acris* was recorded in all the meadows though it was less common in Honey Slough West and Lyon field. Variations in average frequency from year to year were in the range of 32 per cent in 1997, to 76 per cent in 2001. In those years in which it was more frequent, the meadow landscape would be bright yellow in colour at the time of flowering. In the Latin square investigation there was a reduction in 1990 of the frequency in all of the three management treatments. Crothers (1991) noticed similar patterns for buttercups in grasslands in Somerset but could find no obvious reason for the patterns. For those years (1985–1990) in which the two studies

overlapped, the patterns in Middlesex and Somerset coincided. Graphical comparisons for Fryent Country Park suggest a possible relationship to the quantity of ground water during the previous two summers. In the Latin square investigation, there were no statistical differences between the frequencies of meadow buttercup in hay-harvested plots as compared with the flail-cut unharvested plots, but the species declined when cutting ceased. A project on the distribution of *R. acris* and *R. repens* in the two fields of Oldefielde Grove and Gotfords Hill was undertaken by Hagglund (1989).

Creeping buttercup *Ranunculus repens* was recorded in all the meadows, and was less frequent in the same two meadows as for *R. acris*. Variations in average frequencies ranged from 9 per cent in 1997 to 64 per cent in 1989 and the patterns were similar to those for *R. acris*. In the Latin square investigation, the highest frequencies of *R. repens* were in the hay-harvested plots, with lower frequencies in the flail-cut plots and the lowest frequencies in plots following the cessation of cutting.

Celery-leaved buttercup *Ranunculus sceleratus* was recorded in two meadows, both near to the more typical habitat of pond margins; and in at least one case on disturbed ground within a meadow. **Lesser celandine** *R. ficaria* was visible in the short springtime sward and was recorded in six meadows.

Opium poppy *Papaver somniferum* was recorded in three meadows in 1987 following unauthorized waste tipping; whilst **common poppy** *P. rhoeas* was recorded in four meadows following ground disturbance.

English elm *Ulmus procera* suckers originating from hedgerows, were recorded in two meadows and mainly coincided with a period during which there was no mowing of paths alongside hedgerows. **Common nettle** *Urtica dioica* was recorded in most of the meadows, and particularly in Honey Slough West and Lyon field, possibly because of the absence of cutting in some years. **Pedunculate oak** *Quercus robur* occurred as seedlings and/or coppiced plants in some meadows, possibly sourced from the hedgerow oak trees by gravity, birds and mammals. Variations from year to year could have been related to factors such as the mast years of the oaks and to fields being left uncut for a year. **Alder** *Alnus glutinosa* persisted as a coppiced tree in one meadow where it appeared to have originated from a tree-planting scheme that was subsequently mown back to grassland.

Many-seeded goosefoot *Chenopodium polyspermum*, **fig-leaved goosefoot** *C. ficifolium*, **fat-hen** *C. album* and **spear-leaved orache** *Atriplex prostrata* established in several meadows following fly-tipping and ground disturbance. Of these, *A. prostrata* had the highest frequencies (of up to 40 per cent in one meadow), but frequencies of these species declined as grassland was re-established.

Chickweed *Stellaria media* was associated with areas of rough grassland or with ground disturbance. **Greater stitchwort** *S. holostea* was recorded in one meadow where it grew from a hedgerow. **Lesser stitchwort** *S. graminea* had high frequencies in Half Yardes Meade (80 per cent) and in Lyon field, but was recorded in only a few other meadows. Annual average frequencies were in the range of 1.7–7.5 per cent.

Common mouse-ear *Cerastium fontanum* had average frequencies with lows of 2 per cent in 1996 and 0.5 per cent in 2003, and peaks of 20 per cent in 1991 and 19 per cent in 1998. Present in almost all meadows with frequencies in individual meadows reaching 60 per cent. The multivariate analysis suggested that the species was associated with uncut meadows rather than with hay-harvested meadows. The first, and to date only, record of **sticky mouse-ear** *C. glomeratum* at Fryent Country Park was in Honey Slough West in 2005.

Corncockle *Agrostemma* spp., identified as *A. githago* at the time, was recorded in Lyon meadow during the summer of 1991. Another single plant was found in 1991 on a roadside mound at the park, approximately half a kilometre away. Whilst the roadside mound was on disturbed and probably imported soil, there was no obvious source of ground disturbance in the sward at Lyon field. Authorities (Burton 1983; Preston, Pearman and Dines 2002) doubt if the native *A.githago* now occurs in London, though introduced seed was a possibility.

Red campion *Silene dioica* was recorded in four meadows in 1988, two years after significant ground disturbance. Meadow populations peaked in about 1990 and

continued until 1994. It is suggested that the initial source of these plants was seed from nearby hedgerows, but that the new populations declined following the resumption of hay harvesting and the re-establishment of the grassland sward.

Redshank *Persicaria maculosa*, though present in 1985, was primarily associated with the disturbed ground of several meadows in 1987, reaching a frequency of 50 per cent in one meadow, but was not recorded in meadows after 1992. **Pale persicaria** *P. lapathifolia* was recorded at low frequencies on disturbed ground in three meadows in 1987. **Knotgrass** *Polygonum aviculare* was recorded in most of the meadows, often near to the gaps between fields and on other poached ground. Peak frequencies of up to 30 per cent were recorded in 1987 in fields subject to ground disturbance, but it did not persist under hay-meadow management. **Black-bindweed** *Fallopia convolvulus* was recorded in two meadows.

Dock species that were recorded in most or all meadows were **common sorrel** *Rumex acetosa* particularly at Half Yardes Meade and meadows on the west of the park, **curled dock** *R. crispus* particularly on disturbed ground, **wood dock** *R. sanguineus*, and **broad-leaved dock** *R. obtusifolius,* another species associated with disturbed ground.

Perforate St John's-wort *Hypericum perforatum* and **imperforate St John's-wort** *H. maculatum* appeared to be colonists of disturbed ground and were represented by a small number of plants. **Square-stalked St John's-wort** *H. tetrapterum* appeared to be long-established in Honey Slough West.

Sweet violet *Viola odorata* was recorded in one meadow; while **garden pansy** *V.* × *wittrockiana* was probably introduced to disturbed ground from fly-tipped waste. There were two records of **white bryony** *Bryonia dioica* where the plant had originated from a hedgerow.

Goat willow *Salix caprea*, *S.* × *reichardtii* (*S. caprea* × *S. cinerea*); and **grey willow** *S. cinerea*. As meadow plants, willows could be difficult to identify to species level as the annual cutting produced coppiced plants that could have atypically shaped leaves. Thus some of the records could have been misidentifications between the three species. Most records were of grey willow and this species also colonized disturbed ground in some meadows.

Hedge mustard *Sisymbrium officinale* was recorded in meadows subject to ground disturbance. **Dame's-violet** *Hesperis matronalis* was recorded on disturbed ground following fly-tipping in a meadow. **Winter-cress** *Barbarea vulgaris* records were mainly from Honey Slough West, and following ground disturbance in meadows on the west side of the park. **American winter-cress** *Barbarea verna* was recorded in one meadow. **Marsh yellow-cress** *Rorippa palustris* was represented by one record on disturbed ground and the origin of the plant was probably from a nearby pond. **Horse-radish** *Armoracia rusticana*, recorded in one meadow, could have originated from nearby hedgerows or from waste-tipping.

Cuckooflower *Cardamine pratensis* plants were evident during the spring at three meadows on the west of the park. **Narrow-leaved bitter-cress** *C. impatiens*, was recorded on slightly poached ground near to the edges of three meadows and hence near to the sources of seed. Typically, it was not a meadow plant, but locally a species of damp hedgerow edges, open herbaceous habitats, stream-sides, and disturbed ground (Williams 2000). **Hairy bitter-cress** *C. hirsuta* occurred in the meadows on the open ground of disturbed soil or bare soil.

Sweet alison *Lobularia maritima*, **shepherd's-purse** *Capsella bursa-pastoris*, **swine-cress** *Coronopus squamatus*. **Lesser swine-cress** *Coronopus didymus*, **turnip** *Brassica rapa* and **charlock** *Sinapis arvensis* were associated usually with disturbed ground and some could have been introduced to the meadows with waste material. **Hoary-mustard** *Hirschfeldia incana* was represented by one record. **Scarlet pimpernel** *Anagallis arvensis* was recorded in three meadows of which at least one was on disturbed ground.

Meadowsweet *Filipendula ulmaria* occurred as extensive clumps towards the northern end of Honey Slough West, while a few plants were present in other meadows. Since 1985, plants grown from seed collected at the park have been planted into other meadows. **Brambles** *Rubus fruticosus* agg. were recorded sporadically in most of the

meadows and possibly established via bird or other animal vectors. Management of fields by hay harvesting was seldom conducive to bramble growth or to their specific identification, though where grasslands were left uncut these plants could become established. **Creeping cinquefoil** *Potentilla reptans* was primarily confined to meadows on the west side of the park, particularly Upper Hydes West where frequencies reached 40 per cent.

Great burnet *Sanguisorba officinalis* occurred in Half Yardes Meade, Honey Slough West and Lyon fields, with outliers in Lower Hydes East, Goldringe Strip, Richards West, Richards East, Great Hillcroach; and prior to conversion to a car park, in Meade West; and in Upper Hydes East before draining and land-filling. These possibly represented the remnants of a population on the low-lying London Clay grasslands along the River Brent and its tributaries (see Kent 1975). Within the Country Park, rescue translocations of the rootstock were made from fields subject to changes in land use. The success rate appeared to have been high and the plants persisted for many years. Similarly, young plants were nursery grown from seed collected from the Country Park and planted into some meadows. Though colonization of new meadows by seed has not been noted locally, new plants did establish from seed scattered onto the disturbed ground of recently constructed ditch sides. Average frequencies across all meadows were up to 5 per cent, compared with up to 70 per cent in individual meadows. A new host food plant association was recorded for the peppered moth *Biston betularia* (Williams 1988).

Roses *Rosa* spp. were recorded in a few of the meadows, though due to the periodic cutting the specific identification of the plants was seldom possible. **Blackthorn** *Prunus spinosa* plants growing far from the hedgerows may have established from seed but appeared to be short-lived as a meadow species. Blackthorn was also present in the hedgerow edges of most meadows and from where it would sucker into the meadows, though the monitoring tended to avoid atypical areas of the sward at the field edges. Suckering was particularly noted during the late 1980s to early 1990s, before the site management was altered to contain the species by the flail cutting of meadow edges. **Pear** *Pyrus communis*, established as a single plant in Warrens/Blacklandes from 1992 to 1997, but was susceptible to damage firstly from field voles that colonized a nearby unmanaged meadow, and then to hay harvesting.

Broad-leaved cockspurthorn *Crataegus persimilis* occurred as one plant in Long Down in 1998, possibly from seed from street trees along Fryent Way. **Common hawthorn** *C. monogyna* was identified in one quadrat; while **hybrid hawthorns** *C.* × *media* represented the majority of hawthorn records in the meadows. The other parent, **Midland hawthorn**, would not be expected to occur in meadows, though the hybrid and the two parent species occur in local hedgerows (Williams 1989).

Goat's-rue *Galega officinalis* was found on disturbed ground in meadows following fly-tipping and in meadows alongside the roadside mounds where it could have been introduced with the material used for the construction of the mounds.

Common bird's-foot-trefoil *Lotus corniculatus* was represented by one plant in Half Yardes Meade from 1986 to 2001. Three other records were from two meadows, and possibly originated from the introduced seed applied to the topsoil following the construction of mounds alongside Fryent Way. **Greater bird's-foot-trefoil** *L. pedunculatus* was recorded in approximately half of the meadows, with the highest frequencies, of up to 40 per cent, in Half Yardes Meade.

Tufted vetch *Vicia cracca* was recorded in most of the meadows to give typical annual average frequencies of 1–3 per cent, though the highest frequencies, of up to 50 per cent, were from Half Yardes Meade.

Hairy tare *Vicia hirsuta*. Recorded in all meadows, the frequency in individual meadows reached 100 per cent in some years. Average frequencies for all meadows ranged from as high as 61 per cent, in 1997, to just one record in one meadow in 2001. In the years either side of this low, the average frequencies were 10 per cent in 2000 and 18 per cent in 2002. In the plots in Warrens / Blacklandes during 1989 to 1994 (Williams, Fowler and Jarvis 1999), average frequencies increased from zero during the first year, which suggested the presence of a buried seed-bank. This variability could have been linked to weather-related factors, possibly to mild winters and hot or dry summers. Frequencies of hairy tare were highest in the hay-harvested plots, with lower

frequencies in the flail-cut plots and the lowest frequencies in plots following the cessation of cutting. **Smooth tare** *V. tetrasperma* had high frequencies in Richards East and Bugbeards / The Brache, but was absent from some meadows. Average frequencies varied from one record in one meadow in 2001 to 20 per cent in 2004. Variability could have been linked to weather-related factors. Declines in frequency at Richards East from 80 per cent in 1992 to zero in 1993, 1994 and 1995, before increasing again to 80 per cent in 1996, suggested the presence of a seed bank.

Common vetch *Vicia sativa*. Recorded in all the meadows and with frequencies of up to 100 per cent, common vetch was relatively infrequent in some meadows. In common with other annual species of *Vicia*, there were large changes in frequency from year to year, both in the monitored meadows and in the experimental plots, probably as a result of weather-related factors, and the role of a seed bank was suspected. In the monitored meadows the highest average frequency (83 per cent) was in 1997 and the lowest (1 per cent) in 2001. In the Latin square investigation, there were no statistical differences between the frequencies of common vetch in hay-harvested plots as compared with flail-cut but unharvested plots, but the species did decline when cutting ceased.

Meadow vetchling *Lathyrus pratensis* was recorded in all meadows, sometimes in all quadrats. Average frequencies increased from a low of 17 per cent in 1985 to 64 per cent in 2003. Less prone to the large year-to-year population changes of the annual legumes, there were some changes in average frequencies from year to year, e.g. from 50 per cent in 2000 to 36 per cent in 2001 and increasing to 58 per cent in 2002.

Ribbed melilot *Melilotus officinalis* was recorded once. **Black medick** *Medicago lupulina* was recorded in 1988 and 1992, with possible origins from introduced waste, soil or seed used on roadside mounds. Whilst there were some pre-1983 site records for the presence of this species, the records for this species in Williams (1986) are largely in error for *Trifolium dubium*.

White clover *Trifolium repens* tended to decline during the investigation from the early years when it was usually present in all meadows and the average frequency was as high at 42 per cent as in 1987, to as low as 0.6 per cent in 2005. This could have been due to a succession of the grasslands from short, relatively open swards to a tall sward dominated by false oat-grass casting more shade near to the ground. In recent years white clover was usually confined to the mown paths. **Alsike clover** *T. hybridum* was possibly a relic from agriculture and was recorded in some meadows, particularly Goldringe Strip and Long Down. **Lesser trefoil** *T. dubium* was more frequent in the meadows in the east of the park than on the west side or in Half Yardes Meade and it was not recorded from Lyon field. Frequencies in individual meadows reached 100 per cent. Average frequencies tended to decline, ranging from 54 per cent in 1985 to a few records in a few meadows in 2005, possibly due to changes in the height of the sward. There was considerable year to year variation, also noticed in the Latin square investigation, which appeared to be related to weather factors. **Red clover** *T. pratense* occurred in all but two meadows, and appeared to be affected by both succession and by year-to-year factors. The highest frequency in one meadow was 90 per cent, while average frequencies ranged from 25 per cent in 1987, to 15 per cent in 2000 yet 0.8 per cent in 2001. In the Latin square investigation, the highest frequencies of red clover were in the harvested plots, but there were no statistical differences between the frequencies in the flail-cut but unharvested plots as compared with the plots where cutting ceased.

Great willowherb *Epilobium hirsutum* had a widespread but scattered distribution. The highest frequencies occurred in 1988 and 1990 on disturbed ground, where it was often found within ruts left by vehicles. **Hoary willowherb** *E. parviflorum* was recorded on disturbed ground. **Broad-leaved willowherb** *E. montanum* was recorded in two meadows. **Square-stalked willowherb** *E. tetragonum* was recorded in the two adjacent meadows of Honey Slough West and Lyon field in 1988. **American willowherb** *E. ciliatum* was usually a species of disturbed ground; as was **rosebay willowherb** *Chamerion angustifolium*.

Small-flowered evening-primrose *Oenothera cambrica*, **sun spurge** *Euphorbia helioscopia* and **petty spurge** *Euphorbia peplus* appeared on disturbed ground, and could possibly have been introduced from fly-tipped waste. **Flax** *Linum usitatissimum* was recorded as a single plant in 1997 from the summit of Gotfords Hill. **Field maple**

Acer campestre occurred as one record, possibly from seed from nearby hedgerows. **Sycamore** *Acer pseudoplatanus* arose on disturbed ground in one meadow and possibly from seed introduced with fly-tipped waste.

Cut-leaved crane's-bill *Geranium dissectum* was an annual species subject to year-to-year variations in frequency similar to those of the annual legumes. The highest average frequency was 30 per cent in 1998, while the lowest was 0.5 per cent in 2001 followed by a recovery to 17 per cent in 2002. Frequencies in individual meadows reached 100 per cent and cut-leaved crane's-bill appeared to be particularly frequent in the adjacent meadows of Goldringe Strip, Goldringe, Richards East and Meade East. However it appeared to be absent from some meadows, while at Honey Slough West it appeared to establish after the reintroduction of hay harvesting.

Cow parsley *Anthriscus sylvestris* was recorded in most meadows and the average frequencies ranged from 0.5 to 4.7 per cent. The highest frequencies, of up to 70 per cent were in Lyon field. **Pignut** *Conopodium majus* was recorded in Long Down and where it was more conspicuous during the spring than at the time of the main meadow survey. **Fool's-parsley** *Aethusa cynapium* and **fennel** *Foeniculum vulgare* were represented by one record each, both on disturbed ground, and possibly introduced with fly-tipped waste. **Pepper-saxifrage** *Silaum silaus* was transplanted as a few rootstocks into Goldringe as part of a rescue transplantation from Barn Hill and was recorded in 1989 and 1990.

Hemlock *Conium maculatum* was recorded in five meadows adjacent to a roadside mound, constructed in the late 1980s to early 1990s, along the eastern side of Fryent Way to prevent unauthorized vehicle access to the Country Park. The construction materials were largely imported to the site and as hemlock became established it spread to nearby hedgerow edges and meadows where it was recorded from 1991–1996. Due to the potentially poisonous nature of this plant in a hay crop, there was a programme to remove plants from the meadows and to reduce populations in adjacent habitats.

Stone parsley *Sison amomum* reached frequencies of 40 per cent in Honey Slough West and there were records from seven other meadows. However, frequencies declined from the early 1990s, possibly as a consequence of hay meadow management. **Angelica** *Angelica sylvestris* was recorded in Little Hillcroach from 1991–1997, where it had probably spread from the field pond and from where the plants had been introduced from another site.

Hogweed *Heracleum sphondylium*. Recorded in all but three meadows, hogweed appeared to increase during the investigation. The lowest average frequency was 0.2 per cent in 1987 and the highest was 5.6 per cent in 2005, with frequencies of up to 40 per cent in individual meadows. Much of the increase was due to the establishment of populations in meadows adjacent to roadside mounds particularly affecting Richards East, Meade East and Long Down. Prior to the loss of Meade West to car parking in the early 1980s, the uncut grassland contained much hogweed. **Wild carrot** *Daucus carota* was first recorded as a meadow species in 2005. Previous records from elsewhere in the Country Park were associated with introduced waste.

Bittersweet *Solanum dulcamara*. A few records in 1987 and 1988 from three adjacent fields appeared to be of plants that had colonized disturbed ground or recently uncut areas in a meadow. **Field bindweed** *Convolvulus arvensis* was recorded from five meadows, **hedge bindweed** *Calystegia sepium* was recorded mainly from Lyon field, while **large bindweed** *C. silvatica* had a scattered distribution. The bindweeds appeared to be associated with nearby hedgerow edges and rough grassland habitats, and they declined when hay meadow management was restored.

Field forget-me-not *Myosotis arvensis* occurred following ground disturbance. **Hedge woundwort** *Stachys sylvatica* was found in three meadows where there had been ground disturbance; and in Honey Slough West where the plants appeared to be of hedgerow origin and had persisted at a low frequency of cutting. **White dead-nettle** *Lamium album* and **red dead-nettle** *L. purpurem* occurred as scattered records, probably associated with ground disturbance. **Common hemp-nettle** *Galeopsis tetrahit* was mainly recorded from Lyon field, at a frequency of up to 30 per cent, with occasional records from one other meadow. **Bugle** *Ajuga reptans*, **ground-ivy** *Glechoma hederacea* and **selfheal** *Prunella vulgaris* were recorded as scattered records in a few meadows, while **spearmint** *Mentha spicata* was recorded once.

Greater plantain *Plantago major* was present on well-trodden and mown paths in meadows, but was less frequent under the canopy of the meadow itself. It was also a species of disturbed ground and where it was recorded at a frequency as high as 50 per cent in one of the fields, before declining as the grassland sward re-established. **Ribwort plantain** *P. lanceolata* occurred in some meadows, both as a constituent of the hay and following ground disturbance. The species persisted at one edge of Homefield where the hay meadow merged with a mown and partially horse-grazed path and thin soils overlaid the remains of demolished farm buildings.

The two records of **ash** *Fraxinus excelsior* were presumably from seed from hedgerow trees. **Figwort** *Scrophularia nodosa* was recorded annually in Honey Slough West from 1985–1995; and there was one record from recently disturbed ground in Upper Hydes East East in 1990. **Snapdragon** *Antirrhinum majus*, **purple toadflax** *Linaria purpurea*, a single record of **foxglove** *Digitalis purpurea*, **common field-speedwell** *Veronica persica* and **garden lobelia** *Lobelia erinus* were associated with disturbed ground following the removal of fly-tipped waste from meadows.

Cleavers *Galium aparine* occurred in most fields but was more characteristic of meadows that had not been cut for a few years. The highest frequencies, of up to 90 per cent, were recorded in Lyon field and despite the introduction of annual cutting, cleavers remained a frequent species. **Honeysuckle** *Lonicera periclymenum* was recorded in one meadow and was possibly of hedgerow origin. **Teasel** *Dipsacus fullonum* was recorded in a few meadows either as a result of fly-tipping and ground disturbance or the proximity of roadside mounds. **Devil's-bit scabious** *Succisa pratensis* was introduced to some meadows as part of rescue translocations from Barn Hill where grassland was in succession to woodland.

Spear thistle *Cirsium vulgare* was generally a species of disturbed ground or of meadows that had been left unmanaged for one or more years, but tended to decline when hay harvesting was reintroduced. **Marsh thistle** *C. palustre* was recorded as a meadow species only on disturbed ground, with possible seed sources nearby at the margins of a nearby pond and/or from old grassland on Barn Hill.

Creeping thistle *Cirsium arvense* was recorded in all meadows. It was a pest species since it is avoided by livestock and hence by farmers when harvesting hay. Creeping thistle was affected by grassland management and it was particularly a species of under-managed meadows that were uncut for one or more years (see Parr and Way 1988, Williams 2002, Williams and Mercer 2002). In the Latin square investigation the highest frequencies of creeping thistle were in meadows and plots where cutting had ceased, as compared with the flail-cut and hay-harvested plots. In grasslands, creeping thistle spreads mainly by the root-system, with dense populations spreading out from each focus (see Moody and Mack 1988 for a mathematical analysis). The presence of creeping thistle in adjacent habitats such as hedgerows, roadside mounds and unmanaged grasslands was not a problem, since despite the quantity of seed produced, little can establish in well-managed grassland. Thus, at the Local Nature Reserve, creeping thistles could be maintained for biodiversity alongside meadows that were managed for a hay crop. However when meadow swards were damaged, creeping thistles established on the disturbed soil and frequencies increased. Once established, frequencies tended to remain stable at one cut per year, so additional cutting was required to reduce populations. Effective reductions were achieved with two cuts per year (hay harvesting and an aftermath cut in late August or September) or three cuts per year (in May, during the harvest, and an aftermath cut), before returning to the usual one cut per year. Fields that would require an aftermath cut were identified at the time of the annual monitoring in late June, using the frequencies for the creeping thistle. Average frequencies at the Country Park were 15 per cent in 1985, but increased to 48 per cent by 1992 and with frequencies in some fields reaching 100 per cent, though the management programme enabled a reduction in average frequencies to within a range of 17–26 per cent.

Common knapweed *Centaurea nigra* was recorded during the baseline years of the meadow survey as only one or a small number of plants in Short Down East, despite larger populations within the remnant grasslands of Barn Hill. Subsequently common knapweed, primarily of local origin, was introduced to other meadows by seed and as plugs. The plugs generally achieved a high success and persisted.

Nipplewort *Lapsana communis* was a species of disturbed ground. **Cat's-ear** *Hypochaeris radicata* was recorded in eight meadows in 1985, but more recently was found only in Half Yardes Meade. It appeared to be a species adapted to shorter and more open grasslands than those of a tall meadow sward. **Autumn hawkbit** *Leontodon autumnalis* was another low-growing species that declined during the investigation, though it was also found on disturbed ground where the grassland had been scraped to remove fly-tipping. **Bristly oxtongue** *Picris echioides* had scattered records, except where ground had been disturbed and in some meadows alongside roadside mounds where frequencies reached 30 per cent.

Goat's-beard *Tragopogon pratensis* was probably present in all meadows, with clusters of relatively high frequencies in some meadows which persisted for a few years. There were marked changes in average frequency from year to year, with the lowest average frequency in 2004 when there was only one record from one meadow, whereas the highest average frequency of over 9 per cent was in 1998. **Salsify** *T. porrifolius* was first recorded near to allotments in Little Cherrylandes, and then spread to the adjacent Gotfords Hill and to five other adjacent meadows.

The **sow-thistles** were species of disturbed ground. **Perennial sow-thistle** *Sonchus arvensis* was recorded in one meadow; **smooth sow-thistle** *S. oleraceus* reached a frequency of 50 per cent in one field with a few scattered records in other meadows; and **prickly sow-thistle** *S. asper* was recorded in a few meadows.

Prickly lettuce *Lactuca serriola* was recorded from disturbed ground. **Dandelions** *Taraxacum* agg. were recorded from all meadows but the maximum frequencies from individual meadows were seldom more than 20 per cent though there were cases as high as 50 per cent; and on disturbed ground, of 90 per cent. Dandelions appeared to be more widely distributed in the early years of the investigation, perhaps due to a more open and shorter meadow sward.

Rough hawk's-beard *Crepis biennis* was found as a single plant in Little Cherrylandes in 2000 and the identification was confirmed by Rodney Burton (pers. comm.). There have been no other records from elsewhere in Fryent Country Park and it was possible that seed could have been introduced from agricultural machinery. **Smooth hawk's-beard** *C. capillaris* was recorded from a few meadows following ground disturbance. **Beaked hawk's-beard** *C. versicaria* was present particularly in Homefield, and also from Homefield North and two other meadows.

Marsh cudweed *Gnaphalium uliginosum* was recorded in some years from poached ground near to field entrances and from disturbed ground. **Canadian goldenrod** *Solidago canadensis* grew as a clump in Warrens East, at least between the years 1986–2000. *Aster* spp. mainly **common Michaelmas-daisy** *A.* × *salignus* were mainly from the disturbed ground of meadows where fly-tipping had been removed, and elsewhere from meadows adjacent to Fryent Way. **Canadian fleabane** *Conyza canadensis* was also a species of disturbed ground.

Daisy *Bellis perennis* was confined in the meadows mainly to disturbed ground or on the short grassland of frequently mown paths and recreational areas. **Feverfew** *Tanacetum parthenium* was recorded in some meadows following ground disturbance and fly-tipping. **Mugwort** *Artemisia vulgaris* was a species of disturbed ground in meadows and of meadows adjacent to roadside mounds. **Yarrow** *Achillea millefolium* records were from that side of Homefield adjacent to horse-grazed fields; and from meadows adjacent to roadside mounds. **Oxeye daisy** *Leucanthemum vulgare* was introduced, usually as plugs, but there was a single record in one meadow that followed fly-tipping and ground disturbance. **Shasta daisy** *L.* × *superbum* occurred following fly-tipping and ground disturbance.

Mayweeds were recorded on the poached ground of meadows particularly near to field entrances, and on disturbed ground following vehicle access and the removal of fly-tipping. **Scented mayweed** *Matricaria recutita* was more often recorded on poached ground, while **pineappleweed** *M. discoidea* and **scentless mayweed** *Tripleurospermum inodorum* were recorded more frequently following larger scale ground disturbance. In the case of the scentless mayweed, frequencies reached 40 per cent, but declined when the grassland sward was re-established.

The **ragworts** *Senecio* spp. are poisonous if eaten by livestock and to humans at the top of the foodchain. Toxicity is retained when the herbage is conserved to hay and in the

dry state it is difficult for herbivores to distinguish ragworts from other herbage, whereas they can usually selectively avoid ragwort in the live state. Farmers avoid harvesting ragwort-infested hay and have a responsibility, reinforced under the Ragwort Control Act 2003, to manage **common ragwort** *S. jacobaea* where herbage forms part of the human food chain or is near to horses. The Act takes a risk reduction approach as eradication of common ragwort is not an aim. In the hay meadows at Fryent Country Park, ragworts have been managed primarily by the maintenance of a meadow sward avoiding unmanaged grassland and damaged ground. Where infestations have become significant, hand pulling (with gloved hands) and removal of the material has been used, though this can leave the rootstock to regenerate. *S. jacobaea* occurred in some meadows though most of the records were on disturbed ground. The maximum average frequency was less than 1 per cent and in some recent years no plants were recorded in the meadows. **Hoary ragwort** *S. erucifolius* was the most frequent ragwort in the meadows. It increased rapidly in fields after ground disturbance to reach a frequency of 40 per cent in one meadow and an average of 2 per cent over all meadows, but more recently was at a low fraction of 1 per cent. **Oxford ragwort** *S. squalidus* and **groundsel** S. *vulgaris* occurred in a few meadows after fly-tipping and ground disturbance.

Colt's-foot *Tussilago farfara*, **pot marigold** *Calendula officinalis* and **shaggy-soldier** *Galinsoga quadriradiata* were associated with disturbed ground and possible introduction from waste material. **Trifid bur-marigold** *Bidens tripartita* was a species of disturbed ground and of wet meadow areas. The seed source was probably from nearby ponds.

Toad rush *Juncus bufonius* was found on poached ground in wetter years and on disturbed ground. **Jointed rush** *J. articulatus*, **hard rush** *J. inflexus* and **soft-rush** *J. effusus* were recorded mainly on disturbed ground; whereas **compact rush** *J. conglomeratus* was the most widespread of the rushes in the meadows but with average frequencies of less than 1 per cent.

False fox-sedge *Carex otrubae* was recorded in four meadows of which the largest clump was in Warrens East; **spiked sedge** *C. spicta* in three meadows; and **hairy sedge** *C. hirta* in approximately a third of the meadows though at an average frequency of less than 1 per cent and particularly in Honey Slough West.

Meadow fescue *Festuca pratensis* was distributed mainly in meadows on the west side of the park. It was recorded at a frequency of up to 60 per cent in Upper Hydes East East before that meadow sward was damaged by ground disturbance. High frequencies were also recorded in the adjacent Lower Hydes East, and more recently a population appeared to have established in Honey Slough East. The highest average frequency was 3.5 per cent. **Tall fescue** *F. arundinacea* was represented by four scattered records in four meadows. **Red fescue** *F. rubra* was primarily a species in meadows on the west side of the park, particularly Upper Hydes West (to 70 per cent) and Lower Hydes East, giving an average frequency for all meadows of up to 5 per cent.

Perennial rye-grass *Lolium perenne* was recorded in all meadows with frequencies of up to 100 per cent in individual meadows but was infrequent in Honey Slough West, Lyon field and Half Yardes Meade. In the Latin square investigation, the highest frequencies of perennial rye-grass were in the harvested plots, but there were no statistical differences between the frequencies in the flail-cut but unharvested plots as compared with the plots where cutting ceased. The species also indicated a succession from a relatively open and short sward in the early years of the investigation to a taller sward dominated by **false oat-grass** *Arrhenatherum elatius*. Average frequencies for *L. perenne* varied from 77 per cent in 1985, 82 per cent in 1987, 31 per cent in 1997, 64 per cent in 1999, 38 per cent in 2001 and 23 per cent in 2004. Some of the year-to-year variation could have been due to weather-related factors; for example a decline in 1990 in the Latin square plots under each of three treatments. **Italian rye-grass** *L. multiflorum* was recorded in a few meadows up to 1988, possibly as a relict of seed from agriculture though it is possible that all or some of the plants were *L.* × *boucheanum* (*L. perenne* × *L. multiflorum*) which according to Preston, Pearman and Dines (2002) has often been under-recorded for its parents.

Crested dog's-tail *Cynosurus cristatus* was recorded in most meadows but had an uneven distribution and frequencies in individual meadows were as high as 80 per cent. Average frequencies were below 2 per cent in 1985–1987, less than 1 per cent in 1990, 11 per cent in 2000 and less than 2 per cent in 2004.

Annual meadow-grass *Poa annua* was only found in short frequently mown areas, disturbed ground, and on poached ground near to field entrances. **Rough meadow-grass** *P. trivialis* was recorded in all meadows and with frequencies of up to 100 per cent. The Latin square and multivariate investigations indicated that rough meadow grass preferred hay harvesting or flail cutting to no cutting. In the Latin square investigation there was a reduction in 1990 of the species richness in all of the three management treatments which was possibly related to weather factors. In the monitored meadows average frequencies varied from year to year, for example during the years 1996–2005: 88, 26, 70, 87, 61, 95, 80, 64, 77 and 76 per cent respectively. **Smooth meadow-grass** *P. pratensis* occurred in most meadows but was unevenly distributed with maximum frequencies of 30 per cent in individual meadows. Any trend was difficult to discern due to the considerable year-to-year variation; for example from 4 per cent in 1996, 1 per cent in 1997, 6 per cent in 1998, 0.4 per cent in 2000 and 0 per cent in 2001, which suggested the influence of weather-related factors.

Cock's-foot *Dactylis glomerata* was recorded in all meadows; in some cases in all quadrats. Average frequencies appeared to have increased since 1985 (9 per cent) and were above 15 per cent for all years since 1990 except for 2000 (11 per cent). The maximum average frequency was 29 per cent in 2003. **Floating sweet-grass** *Glyceria fluitans* was recorded once, in 1988. The source was probably a nearby pond.

False oat-grass *Arrhenatherum elatius* typified an apparent succession from a shorter, more open sward with a relatively high proportion of **perennial rye-grass** *Lolium perenne*, to a taller sward in which false-oat grass was the structurally dominant species. Average frequencies increased annually from 37 per cent in 1985, to 1993, and remained above 72 per cent since 1991. The highest frequency to date was of 97 per cent in 1998. There was some year-to-year variation, for example the frequencies in the years 1999–2002 were 96, 80, 77 and 89 per cent respectively. Ubiquitous throughout the meadows, the species appeared less frequent in some meadows, e.g. Oldefielde Grove; and visually the abundance appeared to vary even at frequencies of 100 per cent. In the Latin square investigation, no significant differences were noticed between the frequencies of false oat-grass in the hay-harvested, flail-cut and non-cut plots.

Wild-oat *Avena fatua* was recorded in one meadow and was possibly introduced from harvesting machinery. **Yellow oat-grass** *Trisetum flavescens* records were mainly from one meadow. **Tufted hair-grass** *Deschampsia cespitosa* was recorded in almost all meadows, and the average frequencies varied from below 1 per cent in 1996 to over 7 per cent in 1990–1991. Frequencies in individual meadows reached 40 per cent.

Yorkshire-fog *Holcus lanatus* was probably the most frequent species in the meadows, though structurally often overtopped by false oat-grass. With few exceptions it was recorded annually in all meadows and often at a frequency of 100 per cent. At Honey Slough West the species was present at a relatively low frequency until 2000 and then increased, possibly in response to the resumption of harvesting. Average frequencies varied between 83 per cent in 1997 to over 99 per cent in 2002. In the Latin square investigation, the highest frequencies were in the hay-harvested plots, with lower frequencies in the flail-cut plots and the lowest frequencies in plots following the cessation of cutting. In the same investigation there was a reduction in 1990 of the species richness in all of the three management treatments which suggested the influence of weather-related factors. **Creeping soft-grass** *H. mollis* was present in meadows on the west side of the park and in Half Yardes Meade.

Sweet vernal-grass *Anthoxanthum odoratum* had a scattered distribution and occurred at low frequencies. **Canary-grass** *Phalaris canariensis* was represented by a single record though the source of the plants was not known.

The survey team found the **bent grasses** *Agrostis* spp. difficult to identify; both in the vegetative stage and at the flowering stage which was often after the end of the survey period. Most records were aggregated to the generic level and care must be taken in interpreting the data. The most frequent species towards the end of the investigation was **common bent** *A. capillaris*. There were scattered records of **black bent** *A. gigantea*, and a larger number of records of **creeping bent** *A. stolonifera*. Frequencies of *Agrostis* spp. in individual meadows reached 100 per cent, with maximum annual average frequencies of 65 per cent or more. The bent grasses were relatively infrequent in some meadows, such as Honey Slough West, but more frequent in e.g. Half Yardes Meade and Upper

Hydes West. In the Latin square investigation, the highest frequencies of bent grasses were in the hay-harvested plots, with lower frequencies in the flail-cut plots and the lowest frequencies in plots following the cessation of cutting.

Wood small-reed *Calamagrostis epigejos* spread from a hedgerow into an adjacent meadow and was recorded in some years. A second well-established population was found in 2000, in a meadow approximately 200 metres from the hedgerow population.

Meadow foxtail *Alopecurus pratensis* was recorded in all meadows and in some cases in all quadrats though it was generally more frequent in the meadows on the west side of the park. Average frequencies were in the range of 27–36 per cent between 1985 and 1992, and generally within the range of 39–67 per cent between 1993 and 2005. The exception was 2000, in which the average frequency declined to 30 per cent but increased to 63 per cent in 2001. **Marsh foxtail** *A. geniculatus* was recorded in most of the meadows, with the highest frequencies, at up to 40 per cent, in Oldefielde Grove. Average frequencies varied from 0 per cent in 1992 to 3.3 per cent in 1989. Frequencies appeared to increase following relatively wet seasons and to be less frequent following dry winters and summers.

Timothy *Phleum pratense*, though present in most meadows, had average frequencies that did not exceed 1 per cent and during recent years there were only a few scattered records. **Smaller cat's-tail** *P. bertolonii* was more widespread, with frequencies in individual meadows reaching 70 per cent and average frequencies in the range of 7 per cent in 2002 to 16 per cent in 1992.

Meadow brome *Bromus commutatus* plants were recently identified to *B. commutatus* var. *commutatus* by Laurie Spalton (pers. comm.) and it is thought that all records were of var. *commutatus*. The average frequency in 1985 was 28 per cent and increased to 58 per cent in 1990, though there was much year-to-year variation and possibly a decline after 1999, with average frequencies as low as 8 per cent in 2002. The species is an annual and as the English name suggests, is dependent upon and indicative of hay meadow habitats. In the Latin square investigation, meadow brome declined when meadows were flail cut without harvesting of the material; and declined to local extinction when meadows were left uncut for several years. Frequencies could also be dependent upon the time of cutting: typically the seed falls to the ground before harvesting or the seed head shatters during harvesting. Thus, if harvesting is too early, seed may not have developed to a viable stage. Meadow brome was recorded in all meadows and the frequency reached 100 per cent in some meadows. It was infrequent in some meadows, but at Honey Slough West it became established apparently following the commencement of hay harvesting and probably from seed falling from machinery used elsewhere in the Park. **Smooth brome** *B. racemosus* was probably present amongst the larger population of *B. commutatus* before the determination of material in 2002 by Laurie Spalton (pers. comm.). Smooth brome has since been found in ten meadows, giving average frequencies of up to 2 per cent. **Soft-brome** *B. hordeaceus* declined from an average frequency of 44 per cent in 1985 to 16 per cent in 1988, 8 per cent in 1990, 2 per cent in 1994 and to just two records in 2002 and 2004, though there were slight recoveries in some years. **Rye brome** *B. secalinus* was first recorded at Fryent Country Park and in the meadows in 2004, when plants were discovered in adjacent areas of two meadows. The plants were determined as *B. secalinus* var. *secalinus* by Laurie Spalton. The source of these plants is not known but seed from agricultural machinery is a possibility.

Barren brome *Anisantha sterilis* was occasionally recorded in some meadows, usually near to unmanaged hedgerow edges. **Couch** *Elytrigia repens*, though one of the easiest of grasses to identify, was probably under-recorded in some meadows and years by members of some survey teams. Couch was present in all meadows and to a maximum frequency of 100 per cent, with average frequencies in the range of 51–89 per cent and evidence of declines in dry years. In the Latin square investigation, no significant differences were noticed between the frequencies of couch in the hay-harvested, flail-cut and non-cut plots.

Wall barley *Hordeum murinum* was recorded as scattered plants usually towards the edges of some meadows. **Meadow barley** *H. secalinum* was recorded in most meadows, in some to a frequency of 50 per cent. Meadow barley increased from average frequencies of below 3 per cent in 1985–87 to remain above 5 per cent from 1996. The highest average frequency was 12 per cent in 2001.

Bulrush *Typha latifolia* plants appeared in a damp area of one meadow, possibly in depressions formed by unauthorized vehicle access, and the plants persisted for seven years.

Star-of-Bethlehem *Ornithogalum angustifolium* was possibly planted by a local resident from garden stock in one meadow. **Bluebell** *Hyacinthoides non-scripta* was recorded in one meadow where the plant had spread from a remnant hedgerow between two meadows. Earlier, in the early 1980s, the vegetation of this remnant hedge-bank and ditch and that of the two adjacent meadows, were cut and harvested as one field. *H. non-scripta* × *H. hispanica* occurred in two meadows, in one of which it is thought to have been planted from garden stock by a local resident; and in the other was possibly naturalized.

Wild onion *Allium vineale* had records from Half Yardes Meade and from the adjacent Honey Slough East. **Daffodil** *Narcissus pseudonarcissus* was introduced to one meadow from commercially grown but reputedly native origin, but only a small number of plants survived, whereas other daffodils *Narcissus* spp. were assumed to be planted by persons unknown in a number of meadows. **Garden asparagus** *Asparagus officinalis* ssp. *officinalis* was recorded from Little Hillcroach, and three adjacent meadows. **Yellow iris** *Iris pseudacorus* clumps established in two meadows. In one meadow (Upper Hydes East East) the plant could have been introduced by planting or from fly-tipped waste; while at Oldefielde Grove it is thought that rhizomes fell from machinery as spoil was transported from a pond to the other side of the meadow.

Discussion

The flora of the meadows was affected by a number of influences, and there were probably interactions between these in their effects on the flora. Some of the major influences on the vegetation are summarized below.

Evidence from the monitoring and from a Latin square investigation in one of the meadows (Williams, Fowler and Jarvis 1999) indicated that hay cutting and harvesting was generally conducive to maximizing the plant species richness per unit area in the meadows. Flail cutting, in which the cut material was left on the ground, resulted in some reduction in species richness. The cessation of cutting caused a rapid reduction in plant species richness. The reinstatement of cutting and/or of hay harvesting resulted in the restoration of plant species richness over a number of years. Some species were more responsive to cutting than others; whilst other species, particularly those more usually associated with other habitats, declined in response to cutting. A small number of species were practically confined to the frequently mown paths and recreational areas within the meadows.

Nutrient enrichment was probably not an important factor locally, since no fertilizers had been applied to the meadows since at least 1983; and the meadows have been certified to the Soil Association Organic Standard since 1998.

Species of disturbed ground were particularly noted in affected meadows following fly-tipping of waste and damage caused by unauthorized vehicle access between 1986 and 1990. Much of the fly-tipping was removed with machinery, which left large areas of bare ground until the grasslands re-established from rootstock or from the seed bank. Most of the 'new' species that appeared were subsequently lost when grassland cutting or hay harvesting was restored. Some species were characteristic of ground poached by frequent presence of human walkers.

Fires, usually at the time of hay harvesting, resulted in the loss of the above ground vegetation from some fields or parts of fields. Generally, any changes in flora were short-term, since the rootstock appeared unaffected by above-ground fires.

A small number of species appeared for the first time in the meadows following years of monitoring in which they had not previously been recorded nor from elsewhere in the Country Park or the vicinity. The source of these

plants cannot be ascertained with certainty and whilst germination from a buried seed bank or from other sources is possible, these plants could have originated from seed falling from agricultural machinery that had been used in other areas of the country. Though organic standards reduce the risk of certain types of contamination, it is debatable whether machinery and transport could be completely clean of all seed between sites. Hay harvesting involves several stages and several pieces of tractor-mounted equipment in addition to the vehicles used to transport the crop from the site. In the case of the hay harvesting at Fryent Country Park, farm and contractor equipment is known to have come from areas including Buckinghamshire and Wiltshire.

Accurate records of land use prior to 1983 were seldom available, but for the preceding decades there are some records of cattle grazing; and also that some fields were ploughed in the late 1960s to early 1970s for the growing of cereals. Ploughing may also have occurred during the Second World War; and an aerial photograph dating from this time shows one meadow devoted to allotments though grass strips were possibly retained between the plots to enable access. Since the time that the fields were cleared from the earlier woodland cover, it is though that grazing had been the predominate land-use.

The National Vegetation Classification (NVC) (Rodwell 1992) types present were accessed towards the start of the investigation (Hare 1988). A number of the communities present differed from the standard NVC communities, possibly as a result of land management during recent decades. Hare (1988) found that the types present in the meadows were near to MG1, MG4, MG6 and MG7. The large majority of fields particularly on the east side of the park appeared to be of MG1, a community dominated by *Arrhenatherum elatius*. This is an ungrazed grassland type; and at Fryent Country Park, usually cut for hay. Hare (1988) considered that these could have derived from arable and /or from MG7 grasslands, a species-poor grassland usually of agricultural origin containing much *Lolium perenne*. The data from the monitoring indicate that that process or succession, probably continued between 1985 and 2005, as evidenced by the reduction in frequency of *L. perenne* in the meadows and increases in *A. elatius*. Hare (1988) identified MG6 communities in some meadows on the west of the park, probably indicating past cattle grazing; though these meadows may now be nearer to ungrazed MG1. On the northern edge of the park the MG4 *Alopecurus pratensis–Sanguisorba officinalis* community was identified at Half Yardes Meade and possibly with remnants in Honey Slough West, Lyon field and other meadows, though these low-lying meadows are not now flooded as frequently as the typical community. Other grasslands within the park, but not within the meadows, included MG9; and MG13 on the poached ground of horse-grazed fields. On Barn Hill, remnant grasslands in the former field of Saltcroft suggested MG5, an unimproved meadow and pasture community which contained some grassland species that have not to date been found within the hay meadows (see Williams and Bertrand 1988). Remnants of acid grassland at Coneyvale and towards the summit of Barn Hill were similar to the U1 community of the NVC.

Weather factors could potentially affect numerous stages of the life cycle of a species and there could be interactive and/or cumulative effects (see the discussion and references in Williams and Fowler 1997). In the meadows, some species had atypically high or low annual frequencies in some years that could not be explained by other known factors. These appeared to include the annual legumes, *Geranium dissectum,* and some of the grasses such as *Poa trivialis*. The annual legumes in the meadows appeared to increase in response to dry, hot summers and may have preferred mild and/or dry winters, while grasses may have varied in their drought tolerances. Evidence for a buried seed bank for the annual legumes was suggested by the apparent increase from a zero frequency for the vegetative plants to relatively high frequencies over periods of twelve months. Such species could act as indicators of any longer-term climatic changes.

Large herbivores were not present during the years of the investigation, but during the Latin square investigation, field voles *Microtus agrestis* colonized an area of uncut meadow grassland and selectively grazed the vegetation. Other influences on the flora of the meadows included introductions and translocations; and the proximity of other habitats such as hedgerows and ponds.

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Bats and lighting

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Abstract

This report summarizes studies on bat vision; discusses the function of rods in the bat retina; looks at the sensitivity of bat rods to visible light, their greater tolerance of red visible light, their sensitivity to ultraviolet light; and explores the differences which exist across the species range. It discusses artificial light, including torchlight, security and floodlighting, and reviews regional and national studies undertaken, mainly by bat group members. It tabulates surveys specifically undertaken to inform planning applications for floodlighting in London under the Habitats Regulations 1994 and Planning Guidance PPS9. It looks at types of mitigation that have been used in areas frequented by bats. In short, it summarizes what we already know, have known for a long time, questions recent departures from good practice, and appeals for a common-sense approach for the future.

Introduction

Bat biologists have interpreted a bat's behaviour in response to light levels as predator avoidance, when there is actually ample evidence to show that their own eye physiology guides them to exploit low light levels and avoid disorientating bright light. This evidence is acquired from studying bat electroretinograms (a medical test that measures the retina's response to light) used in ophthalmic research.

This has meant that we are constantly disadvantaged when responding to lighting proposals which are near dark corridors or foraging areas known to be of interest to bats. Our unpublished surveys have failed to establish a protocol defining when surveys and mitigation are required for schemes proposing lighting enhancements, such as floodlighting applications for sports pitches, road-widening schemes, decorative and security lighting. Each application has to be argued from scratch and is dealt with differently.

Recently there has been a surge in lighting applications in the London region, perhaps due, in part, from release of funds from the Heritage and Sports Lottery Fund. Some of these recent schemes have been approved without an ecological assessment, even though sports pitches are usually on floodplains and in river valleys, which also serve as wildlife corridors. No doubt this pressure will increase as the 2012 Olympic Games draw near.

Bat vision

Vision is very important to bats and observations of bat use of vision are well documented. For example, early emerging bats do not usually echolocate when

leaving their roost; they use their vision. On moonlit nights they can avoid capture nets, not by using echolocation but by vision (Wang et al. 2004). Microchiropteran bats seem to be far-sighted, indicating that vision is used predominantly at long ranges, which is where echolocation does not work so well. Highflying migratory bats switch off their echolocation using their vision, and this is often when they fly into wind turbines (Johnson et al. 2003).

Ongoing experiments on microbats suggest that they may rely on vision more than was originally considered (Elköf and Jones 2003). They revealed that visual cues were more important to foraging brown long-eared bats *Plecotus auritus* than acoustic ones. There were more feeding attempts at dishes that provided only visual cues, compared with those that provided only sonar cues, suggesting that they preferred to locate food by sight. Various studies have revealed that bat vision works better in dim light. There is a wealth of research on bat use of vision, morphological differences including eye shape and size, presence of certain light-detecting genes and sensitivity to ultraviolet (UV) light as outlined below.

Rods and cones

The human retina is packed with two types of receptor cells called rods and cones (names reflecting their shape). Cones work in bright light and register detail. Cone-like structures (receptor cells with pedicles) are present in some aerial hawking insectivorous bats such as greater white-lined bat *Saccopteryx bilineata*, lesser white-lined bat *Saccopteryx leptura* and long-nosed bat *Rhynconycteris naso* (Suthers 1970, Chase 1970). Presumably these are early emerging species. Most bats have no cones at all and some nocturnal animals just a few. Rods work in low light, detecting basic motion and basic visual information. The rods are more sensitive to faint light than are the cones.

Based on focal distance and diameter of the dilated pupil, Dietrich and Dodt (1970) calculated that the light-gathering power of the mouse-eared bat *Myotis myotis* is four to five times that of man. This suggests that bats can readily use visual cues at dusk, when they normally emerge from their roosts, and probably also under nocturnal conditions (Ellins and Masterson 1974).

Light sampling and emergence times

Our own observations of dusk roost emergence indicate that bats undertake light sampling in the early part of the evening and that prevailing light levels may be a better indication of emergence than time after sunset (Entwistle et al.1996). Many bat species including barbastelle *Barbastella barbastellus*, long-eared bats *Plecotus* species and Daubenton's bat *Myotis daubentonii,* fly internally within their roost voids (barns, churches, caves, culverts and under bridges) prior to their emergence from the building or structure. As light levels dim they will venture out, briefly fly around their point of exit, may pick off a few insects and then return to the roost.

These sorties will be repeated until eventually an exiting bat leaves in a direct manner along its flight path in pursuit of the evening's foraging. Early commentators on this behaviour suggested this was a safeguard from predators. Erkhert (1982) attributes light sampling of pond bat *Myotis dasycneme* as predator avoidance rather than as a function of physiology.

Delayed emergence can occur during very high pressure systems, which intensify and prolong sunsets (e.g. author's studies at South Norwood Country Park, 2004; Seething Wells, 2003; Cannon Hill Common, 2005). This can delay emergence considerably and can skew conclusions as to how far bats have travelled from their roost. A finely balanced combination of sunlight, high pressure, dry air, dust particles and cloud cover can create a prolonged sunset. Whilst watching bats emerging from a hibernaculum (Tovey and Fure 2003), pressure reached 1,027 millibars, forming a temperature inversion. A band of warm air was able to trap the dust particles in the atmosphere (MacCaskill

2003), delaying pipistrelle emergence to fifty minutes after sunset. When this occurs, a reading of around fourteen lux on a light meter is a more accurate predictor of pipistrelle emergence, than minutes after sunset. Below one lux (moonlight) is necessary for Daubenton's emergence (author's data, 2006).

Emergence times varied considerably amongst bat species. Light tolerance has been estimated by measuring the luminance of light stimuli required to provoke electroretinogram responses in three species of Vespertilionidae: the mouse-eared bat (Dietrich and Dodt 1970); serotine *Eptesicus serotinus* (Bornschein 1961, cited in Elköf 2005); and big brown bat *Eptesicus fuscus* (Hope and Bhatnagar 1980) and three species of Phyllostomidae: vampire bat *Desmodus rotundus*; short-tailed fruit bat *Carollia perspicillata*; and Jamaican fruit bat *Artibeus jamaicensis* (Hope and Bhatnagar 1980). Among the vespertilionids, the big brown bat showed the highest light tolerance, whilst among the phyllostomids, which generally responded to lower luminance levels than the vespertilionids, the Jamaican fruit bat showed the highest tolerance to light. This reflects the time at which these species normally emerge in the evening, and to what extent they are exposed to bright light (Hope and Bhatnagar 1979).

As may be expected from a retina consisting predominantly of rods, the visual sensitivity generally declines as the ambient illumination increases towards daylight. This indicates that bats' eyes work better in dim light than in bright light. This has been verified behaviourally by Bradbury and Nottebohm (1969), who found that the little brown bat avoids obstacles better under ambient illuminations resembling dusk than they do in bright daylight. The eyes of Microchiroptera work well under low ambient illumination, although the sensitivity to different light levels and the ability of brightness discrimination vary considerably between the different families and species (Eklöf 2005).

Ultraviolet light

Recently, it has become clear that bats from Central and South America that feed on the nectar from flowers can see ultraviolet light, which is more abundant at dawn and dusk. The colour-blind long-tongued nectar bat *Glossophaga soricina* is sensitive to UV down to a wavelength of 310 nm (York et al. 2003). As bats generally lack cone pigments in their eyes, the flower bats capture the ultraviolet with the rhodopsin of their rod pigments. The researchers discovered this ability while keeping the bats in an environment with computer-controlled artificial flowers equipped with small signal lights. Flower-visiting bats seem to need UV vision, because the flowers they visit in the rainforest are characterized by a strong reflection of light at night.These bats can see ultraviolet due to the fact that a UV filter is lacking from their eye lenses. Normally, the UV-absorbing lens protects a mammal's eye from UV radiation. UV light not only damages the retinal cells, but also it causes an out-of-focus image on the retina of the eye. Studies of vespertilionid bat species (see below), demonstrate that short wave frequency light (UV) is most disturbing to them.

Empirical studies

Bat workers participate in the National Waterways Daubenton's Survey NWDS (part of the National Bat Monitoring Programme run by the Bat Conservation Trust). Part of the protocol for this includes a torchlight scan of the water surface to verify bat passes. In a research project undertaken to establish whether this light actually repelled some of the bats, Monhemius (2001) found that the reduced number of Daubenton's passes when using torchlight was significant. The most accurate count was achieved with a red filter on the torch used to count bats. She concluded that in order to count this species accurately the torch should only be turned on once a bat is heard on

the bat detector, for a minimal period, and should be held stationary rather than scanning the surface of the water.

During my own NWD Survey, along the Thames between Richmond and Kingston Bridges, are several potential 'light barriers' that might affect the foraging activity of Daubenton's bats. At Teddington, the Lock itself is brightly lit and few bats have been recorded at this location. At the last three NWD recording stations along the river at Kingston upon Thames, few bats are found now that waterside and bridge lighting has increased (Table 1). Daubenton's bats particularly have not been recorded on the Kingston side of the river at these three stations, which are monitored by the author, despite their presence at all others. It is known they overfly the brightly lit bridge, as one was hit by a car (perhaps dazzled by headlights) and taken by the driver to Putney RSPCA in 2004. It is only upstream of Ravens Ait that Daubenton's bats begin to use the river again for foraging in any number (Fure 2004).

TABLE 1. Daubenton's waterway survey numbers of passes as approaching Kingston town centre (includes 'unsure species' passes over water).

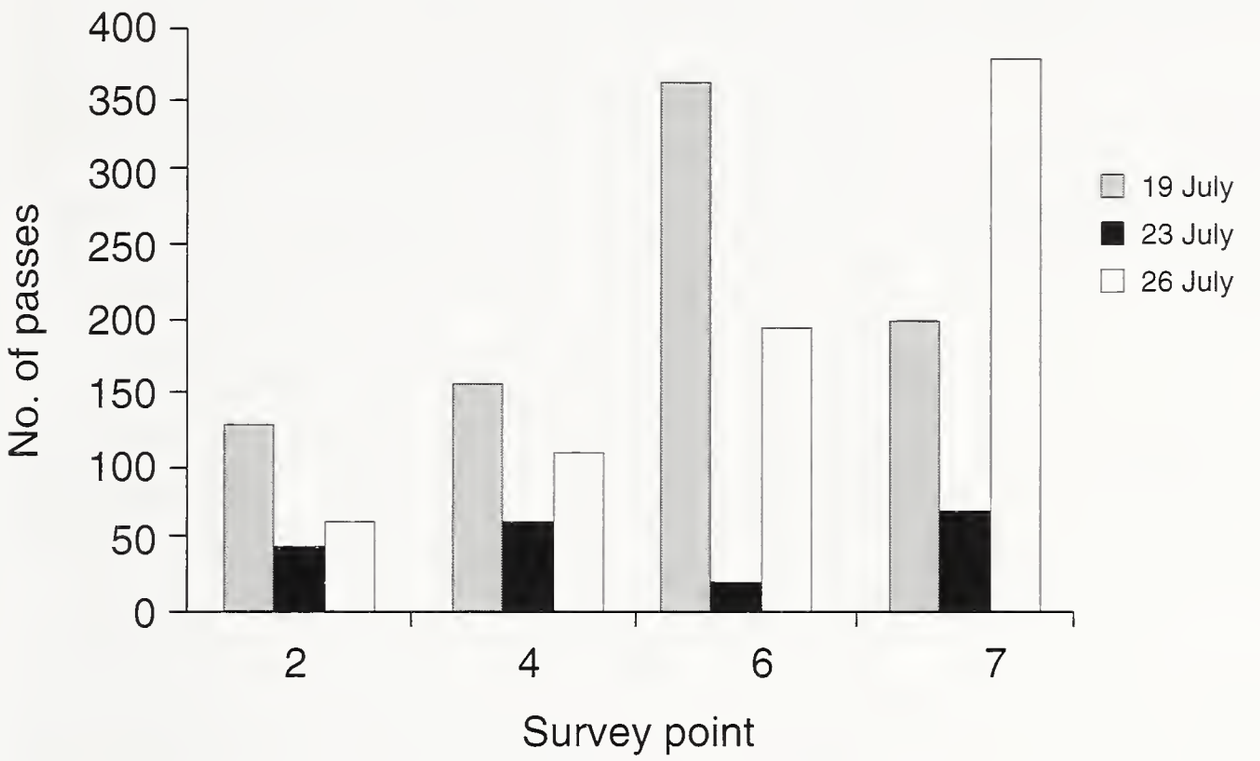
Position	2000 2 visits		2002 2 visits		2004 2 visits		2005 2 visits	
Opposite Steven's Eyot	0	0	0	0	4	0	0	1
First plane tree after Boaters Inn	0	0	0	0	1	3	0	3
At 'No mooring' sign	0	0	0	0	2	7	5	0
After seat in memory of Ernest Leggett	0	2	0	0	1	2	3	0
In front of two lime trees	0	0	9	0	10	4	10	3
On lower path in front of large plane tree	16	27	0	0	6	3	12	2
Thames-side, opposite parking ticket machine at rear of Osiers Court	1	0	0	0	8	2	0	0
Lower portion of John Lewis shop's frontage	0	0	0	0	0	0	0	0
South of Kingston road bridge	0	0	0	0	0	0	0	0
Between Woolworth's and Bradford & Bingley	0	1	2	0	0	0	0	0

In summer 2004, The National Trust invited the Surrey Bat Group (2004) to carry out surveys at Claremont Landscape Garden, Esher (TQ130633), in order to assess the impact on bat activity of annual open-air concerts held in the grounds. It was decided to conduct surveys using bat detectors on three evenings, before, during and after the concerts. Concerts, followed by firework displays, were held in the Garden on the evenings of 22, 23 and 24 July 2004. Bat surveys were conducted on 19, 23 and 26 July 2004, between 21.00 and 22.30. Heterodyne bat detectors were used to record the number of bat passes at these points during each ten-minute period throughout the survey.

To check that bat passes were not missed by surveyors on the night of the concert owing to the loudness of the music, the number of passes heard by the surveyor directly in front of the stage was compared with the number recorded on the minidisk. Numbers of bat passes at all survey points were much lower

on the night of the concert than on the other two nights. It seems that the bats (mainly Daubenton's) had moved feeding site, possibly as a result of the floodlighting of the island and western side of the lake (Surrey Bat Group 2004) (Table 2).

TABLE 2. To show the total number of bat passes during the survey period at each survey point. After Surrey Bat Group (2004). 23 July is the night of the concert.



The conclusion that it is the lighting and not the noise which causes most disturbance to bats is consistent with Mann et al. (2002). They found that human activity in caves can affect bats adversely, especially bats that assemble in maternity colonies. They assessed the responses of 1,000 *Myotis velifer* by manipulating noise and light intensity. They found that light intensity affected bat behaviour most. All bat responses were highest in trials with high light intensity and lowest with no light. Perhaps every bat group now has their own local examples.

The Lancashire Bat Group found, during surveys of a canoe pool, that Daubenton's bats were deterred from feeding over the water when it was in use, though they foraged on nights when the lake was not floodlit (Graham 1996). Street lights have been found to cause a decrease in the numbers of Daubenton's bats and cause them to alter their flightpaths (Jones 2000). Similar studies are outlined in Table 3. Some show a continuously lit portion of a park remaining unused by bats where others highlight a with/without lights comparison.

I have only found Natterer's bat *Myotis nattereri* at a few locations in our region, feeding in areas devoid of lighting, such as: Surbiton Fishponds (2003); Seething Wells (2001–3); Thames at Hampton Water Works (2001); Canbury Gardens (2003); and a SW London park (dawn swarm, 2005). Infrared filming (Hoare 2004) showed Natterer's bats' first emergence from their roost fifty-seven minutes after sunset. It is rarely that surveyors wait as long as an hour after sunset for bats to appear during emergence surveys.

At the Seething Wells Public Inquiries between 1998 and 2003, unchallenged evidence was given regarding the effect of lighting on bats on their foraging areas and commuting routes (presented by Guest 1998) and effect on roosts (presented by Fure 2004). The inspector upheld the evidence

on both occasions and the appeals were dismissed. This was one of the few areas on which all parties were agreed, and it was hoped that written evidence, would have an 'independence' which could be used as a standard of accepted 'best practice'. In 2004, this evidence was cited by an inspector during a separate UDP Inquiry, to designate Seething Wells Metropolitan Open Land (UDP Inspector's Report 2001).

TABLE 3. Reduction of bat activity in London parks and open spaces due to the effects of light spillage from offsite sources (author's data 1999–2005).

Unpublished survey results: brightly lit portions of open space where no bats were found in otherwise busy foraging areas.	**Fairlop Country Park** 2004. Golf course driving range. Details: Whilst bats fed around the lake within the tree canopy, they were not found over the illuminated sections of golf course.
	Claybury Park 2005. Security lighting. Small numbers of bats are found near the woodland and pond areas, but not near the newly developed areas.
	Goodmayes Park 2005. Halogen security lighting. Bat activity is restricted to the northern and central avenues of trees and the water body north of the bridge.
	Valentines Park 2005. Security, neon and floodlighting. Three areas of the park are affected by lighting : two affect the perimeter, but the hotel lighting penetrates deep into the park (Figures 3–4).
	Epsom Common 2003. Golf course driving range. Lighting restricts the movement of bats across Rushett Farm.
With/without	**Wimbledon Park** 2005. Floodlighting around the athletics stadium affects the activity of four species of bat on the nights when it is used.
With/without	**Kingston Recreation Ground** 1999–2003. Reduced bat activity, especially absence of Natterer's when the football stadium is in use.
Without With (no data)	**Muswell Hill.** Bat swarming and feeding area.

Unfortunately, it is members of the public, and not our statutory authorities, who seem to be constantly fighting a rearguard action against those developers who want to illuminate our open spaces. Successes include: Ham Lands LNR, floodlights, 1998 and subsequent appeal dismissed; Ham Lands floodlighting, 2001 and subsequent appeal dismissed; and Hart's Boatyard (Site of Metropolitan Importance), 2003 and 2004 appeals dismissed, but with modifications a 2005 appeal was allowed. The desire to light up current dark open spaces and 'dark corridors' is highlighted by current proposals including: Kneller Gardens proposals, 2005; Bishop's Park by Fulham Football Club, 2005 and Barnes Sports Fields adjacent to the WWT London Wetland Centre (Site of Special Scientific Interest), 2001; and possible illumination of Richmond Bridge (Site of Metropolitan Importance), 2005 (Figure 1).

In summary, bats lack cones in their eyes. Rods allow bats' eyes to receive more light. They are reliant on vision not only when travelling, but also for certain types of feeding as in gleaning (e.g. brown long-eared bat). Bat vision works best in dim light. This vision can be interrupted by greater luminance, thus causing disruption in natural patterns of movement and foraging. This light sensitivity varies between species, but generally tolerance of red visual light is greater than white light. Infrared light has less impact

and we can use this to watch and film bats. Some species lack ultraviolet filters in their eyes which means their eyes would be damaged if they emerged during the day.

Emergence times from roosts appear to provide a surrogate for the differing light tolerance through the range of species. Those bats which emerge late in the evening such as *Plecotus* and *Myotis*, particularly the Natterer's bat, have a reduced tolerance to lighting. As intensity of light increases, even species which are relatively light tolerant are delayed in emergence from their roost. Where bat species are found, care should be taken to ensure that roosts, foraging areas, and corridors for movement of these species are not affected by light pollution.

Light avoidance by bats has been interpreted as a predator-evading strategy. This is only partly true and failure to appreciate the wider impact of light pollution on bat behaviour may affect the conservation of a protected species. Physiological and empirical evidence indicates that planning applications should require surveys and demand remediation in 100 per cent of cases.

Why and when are bat surveys requested?

All British bats are included on Schedule 5 of the 1981 Wildlife and Countryside Act (as amended). This Act was amended by the Countryside and Rights of Way Act 2000. Under this Act, it is an offence:

- intentionally or recklessly to damage, destroy or obstruct access to any structure or place used (by bats) for shelter or protection
- intentionally to kill, injure or take bats
- intentionally or recklessly to disturb bats whilst in their roosts
- to sell, barter or exchange bats (live or dead, whole or in part)
- to publish an advert to buy or sell a wild bat

All British bats are also included on Schedule 2 of the Conservation (Natural Habitats) Regulations 1994 (otherwise known as the Habitats Regulations). Under this legislation it is an offence:

- deliberately to kill or take bats
- deliberately to disturb bats
- to damage or destroy the breeding or resting place of any bat

As bats reuse roosts, legal opinion is that the roost is protected whether the bats are present or not.

Under current planning guidance (PPS9), the Government expects all planning authorities to give very careful consideration to whether an operation is likely to damage the special interest features of a SSSI, and, to consult Natural England. A planning authority should be able to demonstrate that it has clearly considered the likely effects of an operation, and therefore whether it is duty bound to notify Natural England as required by the Act. The planning authority should bear in mind the possibility that certain developments may affect a site some distance away. For example, a wetland site might have its water table lowered as a result of water abstraction some considerable distance away; presumably offsite floodlighting should be considered to have a similar impact. On page 7 of the guidance it is stated 'that, before planning permission is granted, adequate mitigation measures are put in place'. Table 4 outlines some of the examples where lighting surveys have been undertaken in the London region.

TABLE 4. Selected requests for bat surveys, in the London region, prior to and post lighting applications 2002–2005 (author's data).

	Application type	Requested by	Specially designed lighting columns	Planning conditions on use
Requests for bat surveys due to lighting improvements prior to planning permission being granted.	A tennis club, Richmond 2002	Local planning authority	Yes	Yes, restricted times, near flight line
	A football club, Hillingdon 2003	English Nature	No, as no bats were found on the night of the surveys	No information
	A sports club, Ealing 2004	Local planning authority	Yes	Spillage restricted due to proximity of bat foraging area
	A school in Muswell Hill 2003	English Nature	Not known	Suggested, lights off one hour after sunset. Spillage restriction
	A park in South Norwood	Local planning authority	No, as no bats were found on the nights of the surveys	

Mitigation

Use of planning conditions

Conditions are an important way in which planning authorities can influence the design of lighting installations and mitigate their impacts. In relation to lighting, such conditions include: hours of illumination; light levels; column heights; specification and colour treatment for lamps and luminaires; the need for full horizontal cut-off; no distraction to the highway; levels of impact on nearby dwellings; use of demountable columns; retention of screening vegetation; use of planting and bunding to contain lighting effects; erection of demonstration luminaires; and review of lighting impacts after installation. More could be made of the use of light sensors which are activated when they are needed. They are less wasteful of energy, and are considerate of Health and Safety obligations.

Types of lighting

The impact on bats can be minimized by: using low-pressure sodium lamps instead of high-pressure sodium or mercury lamps; fitting mercury lamps with UV filters; maintaining the brightness as low as legally possible; limiting the times during which the lighting can be used to provide some dark periods; directing the lighting to where it is needed to avoid light spillage; and minimizing upward lighting to avoid light pollution: 45 per cent of our lighting is currently low pressure strong yellow lighting. This is gradually being replaced with high-pressure sodium lights. In Kingston upon Thames we have a strange mixture in some roads with the high pressure lights over strategic points such as pedestrian crossings. Light can be restricted to selected areas by fitting hoods which direct the light below the horizontal plane, at preferably an angle

less than seventy degrees. Limiting the height of lighting columns to eight metres and directing light at a low level reduces the ecological impact of the light. This advice would not apply on highways, where research (Highways Agency 2005) suggests that taller lighting columns have less impact on bats as they are less likely to suffer road collisions if they have been foraging near lights. Some companies now use sophisticated software such as CalcuLuX, to design lighting solutions. Luminance Pro Lighting Systems Ltd, based in Surrey, has for many years been designing and manufacturing to minimize light spill and subsequent glare to the neighbouring environment. Information can be factored into a design to calculate *vertical illuminance*. Data such as bat flight paths and roosting/hibernation areas may also be incorporated. The results from these calculations are used to adjust the lighting column positions and heights to ensure, if necessary, a suitable compromise between the sport and the environment is reached. This technique requires the selection of luminaires such as HiLux projectors which dramatically reduce light spill and glare outside an intended area. This allows designs to meet these high standards.

The current drive to improve safety by modernizing sports facilities in parks and rural areas requires specialist design services: to ensure minimal impact on the environment including the night sky (sky glow). HiLux luminaires are widely used in standard applications such as: sports pitches, athletics tracks and tennis courts as well as being suitable for parks and Areas of Outstanding Natural Beauty where facilities for sport and young people are being specified.

Light curfews

A light curfew was imposed as a planning condition on a tennis club in Richmond (author's data 2002).The curfew exists for one hour after sunset throughout April to September to allow bats to complete their passage along a nearby hedgerow. However, residents attest that the lights are turned on regardless of whether or not the tennis courts are in use (a lesson for imposing future conditions). Generally, within the months May to October, areas used by bats should not be illuminated outside after 8.30 p.m. and the lighting of buildings should be limited to special occasions. If it is considered necessary to illuminate a building where roosting or commuting bats pass by, the lights will need to be switched off at bat emergence time and during peak bat activity times (Jones 2000). Road or trackways in areas important for foraging bats should contain stretches left unlit to avoid isolation of bat colonies.

Screen planting and vegetation

This can help screen light pollution considerably. For example, light pollution onto a Site of Grade 1 Nature Conservation Importance in Redbridge was made worse when bushes considered to 'harbour burglars' were removed (Figure 2). Unfortunately, one of the fastest growing species to shield light pollution is Leyland cypress hedging, so it is best not to remove boundary planting in the first place. Tree canopies and their overhang near waterbodies should be retained for foraging bats as they create dark shadows. Evening emergence of Daubenton's bats and initial foraging is often under willows overhanging water, or structures which cast large shadows. It is well established in literature that this species moves roost frequently, especially during the winter, may range widely during their foraging (10–15 km) and may feed throughout the night, yet these principles are never considered when managing waterside trees in London parks where Daubenton's bats *have not* been recorded. By applying the above ecological principles, 'has not been recorded' really means 'the tenacity of the survey was insufficient to find this species'.

By surveying outside of the *usual* recording season, *Myotis* species have been discovered in previously unrecorded sites using many London waterbodies (author's data, Kensington Gardens, 21 October 2004; Cannon Hill Common, 21 October 2005). Mitigation should always be implemented for those trees with large canopies which are to be felled near water as this will be of potential habitat loss to foraging bats in the early part of the evening when light levels are high. In an urban area the loss may be total as removing waterside trees allows artificial light penetration throughout the night (Figure 3). In any event mitigation for the loss of the prostrate willows should recognize the multiplicity of uses by a large range of species, not just bats, for shelter, feeding, and perching.

A case study

This is reproduced from the Department of the Environment (Transport and the Regions) to show how mitigation can look in practice. It is a golf driving range, in Binfield, Berkshire where there was an application for planning permission to install floodlights on the club building and along the perimeter fence of the driving range. The local parish council objected on the grounds that the lighting would cause light pollution and disturb the rural, undeveloped character of the landscape. Planning officers eventually approved the application but responded to the concerns of the local community by enforcing a series of conditions designed to prevent light pollution and limit the environmental impacts of the lighting.

Under the conditions, the floodlights are switched off at 9.30 p.m. during the winter months and the levels of illumination close to ground level are restricted to comply with the levels recommended in the Institute of Lighting Engineers (1992). Earth bunds have been constructed around the perimeter of the range and trees planted to reduce overall visibility and the impact of the floodlighting, which is mounted on the driving range building and on 8-metre columns or fencing posts along both sides of the range. (Figure 4 demonstrates light penetration from a Surrey golf course driving range onto a local nature reserve). Bats did not feature in the mitigation for the application at all.

These safeguards may be appropriate for generalist bat species such as pipstrelle, who can cope with light levels above 14 lux. But what of the *Myotis* species such as Daubenton's emerging when light levels fall below 1 lux. Are we tenacious enough in our surveys to even find this species of bat, going out in all seasons of the year, rather than the April to September period. Do we survey late enough in the evening to find Natterer's bats?

Floodlighting should never be appropriate near open water or rivers which act as feeding areas and flyways for bats (and other species). Our rivers should be maintained, without fail, as dark corridors. Even when safeguards for floodlights are put in place, there is no enforcement of restrictions. When new organizations take over premises their obligations under planning consents do not seem to be inherited. I live forty metres from a floodlit athletics stadium and football club. When the lights are in use in the evenings, I can read a newspaper in my bathroom which registers >2 lux on the light meter. On dark winter mornings the floodlights are used during the daytime. These lights impact on the Hogsmill River corridor, which should be maintained as a dark corridor for wildlife; including its bats, water voles, kingfishers and the small sand martin colony which has used the drainage holes in this catchment since the 1960s.

It is extremely rare to see refusal of floodlighting based on the protection of an area designated for wildlife, but this would be the single most important contribution to many of our local Biodiversity Action Plan targets. When we fail to deal with this issue we ascribe false virtue to the activities contained in many of our species action plans, particularly for bats.

FIGURE 1. Richmond Bridge.

FIGURE 2. Light pollution from the school.

FIGURE 3. Light pollution over the lake at Valentine's Park from 700 metres.

FIGURE 4. Golf driving range across Horton Country Park from one mile.

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People, crows and squirrels — some recent changes at St James's Park

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Abstract

Data are presented on the decline and disappearance of the house sparrow in St James's Park and the recent rapid increase there in the numbers of carrion crows and grey squirrels. Up to 89 crows and 25 squirrels have been counted in the park, but these figures are dwarfed by the numbers culled, with up to 108 crows and 218 squirrels killed there in a year. The relationship between house sparrows, crows and squirrels and members of the public who feed them is discussed.

Introduction

In earlier papers (Oliver 1987, 1992) I reported on changing waterfowl populations in St James's Park. Here I deal with more recent changes in two species of land bird, carrion crow *Corvus corone* and house sparrow *Passer domesticus*, and a mammal, grey squirrel *Sciurus carolinensis*, all of which are, or have been, familiar members of the park's wildlife community. St James's Park was once famous for its sparrows and the men who used to stand near the bridge and attract the sparrows to take food from their hands. The decline of the house sparrow in parts of Britain is well known (e.g. Summers-Smith 2003) and St James's Park has not been immune from this trend, for it has now completely lost its sparrows, and the men that fed them. A few of their survivors however, have adapted and now feed squirrels instead. At the same time, both carrion crows and grey squirrels have at once both increased in numbers and learned to take food from the public, though, in the case of crows, not yet from the hand. This note describes these changes and reviews the possible effects on these creatures of the regular provision of food by the public, a habit that contrasts markedly with the human predilection for culling, a practice recently adopted in the park in respect of both crows and squirrels. Also included is a brief summary of what is known about the earlier status of all three species, based mainly on published information. Other species known to take food from the public in St James's Park are also briefly mentioned.

Methods

I made a few counts of birds in the late 1970s. Then from 1980 to mid 1996 I made extensive observations in the park, usually several times a week, concentrating mainly on waterbirds, but making occasional counts of other species. Unfortunately I collected very little data on house sparrows, but Helen Baker (pers. comm.) has provided counts for most years from 1982 to 1996. I made regular counts of crows from 1988 to June 1996 and again from June

2001 to December 2005, though my visits in the latter period were sporadic until November 2003 from when I made at least one count in most months. Roy Sanderson (pers. comm.) provided further counts, mainly for 2002. I assessed the breeding population of crows in 2004 and 2005 by searching for nests both at the beginning and after the breeding season when the nest-trees were leafless and by noting family parties when young had fledged. I made counts of grey squirrels occasionally from 1980 to 1985, regularly from June 1992 to June 1996 and then once in most months in 2004 and 2005. From November 2003 I kept notes on feeding and other behaviour of both crows and squirrels, particularly when this involved taking food from people. Data on recent culling were supplied by Mark Wasliewski (pers. comm.), the park manager.

Results

House sparrow

St James's Park has received much less attention than the other Royal Parks (other perhaps than Green Park) and there is little specific information on the status there of the house sparrow. Possibly the most telling evidence of its former abundance is a photograph in Fitter (1945) of an old man in the park feeding sparrows from the hand and surrounded by at least a further hundred sparrows on the ground and the nearby fence. Another photograph in Goode (1986) shows a girl feeding a sparrow in the park. Neither photograph is dated, though it seems likely that the one in Fitter pre-dates the Second World War, while the later one is presumably from the early 1980s.

The only published counts appear to be those of Cramp and Teagle (1952) which combine St James's and Green Parks. The mean of four winter counts they made in 1949–50 was 408. I made four counts between February 1976 and January 1982 and Helen Baker eighteen counts between 1982 and 1996. The *London Bird Report* gives records from 1996 to 1999. Data from all these sources are summarized in Table 1. The small number of counts in most years makes interpretation difficult, but there is no clear trend of declining numbers between 1976 and 1989. It is evident, though, that at some time between then and 1996 there was a precipitate fall in numbers leading to the last record of a single individual in May 1999. None has been reported since.

TABLE 1. Counts of house sparrows in St James's Park.

	No. of counts	Mean	Maximum
1976	2	132	157
1981	1	124	124
1982	4	110	149
1984	1	119	119
1987	9	77	114
1988	3	104	124
1989	1	73	73
1992		present	
1993		present	
1996		3 territories	
1997		2 territories	
1998		2 territories	
1999	1	1	1

Carrion crow

As in the case of the house sparrow, there is little direct information about this species in the park. Dixon (1909) mentions it specifically as an area where 'it may frequently be observed'. He does not refer to nesting there, though he does mention it as doing so in other central parks. If it had nested in St James's Park he would presumably therefore have mentioned it. Hudson (1898) also refers to nesting in the Royal Parks, but the context suggests he was referring principally to Hyde Park and Kensington Gardens — St James's Park is not mentioned. He also refers to crows being shot and their nests being pulled down in the Royal Parks. The evidence of these authors therefore suggests that it is unlikely that this species was nesting in St James's Park at the end of the nineteenth century or the beginning of the twentieth century. *Bird Life in the Royal Parks,* an annual or biannual report published by the Stationery Office for at least the years 1939 to 1977, after which publication ceased, refers to confirmed breeding in some years and probable breeding in most other years, but where details are given, they most often refer to nesting in Green Park by no more than one or two pairs. The presence of four crows in a single tree in 1947 was thought worthy of comment. Simms (1974) stated that it only occasionally bred in St James's Park.

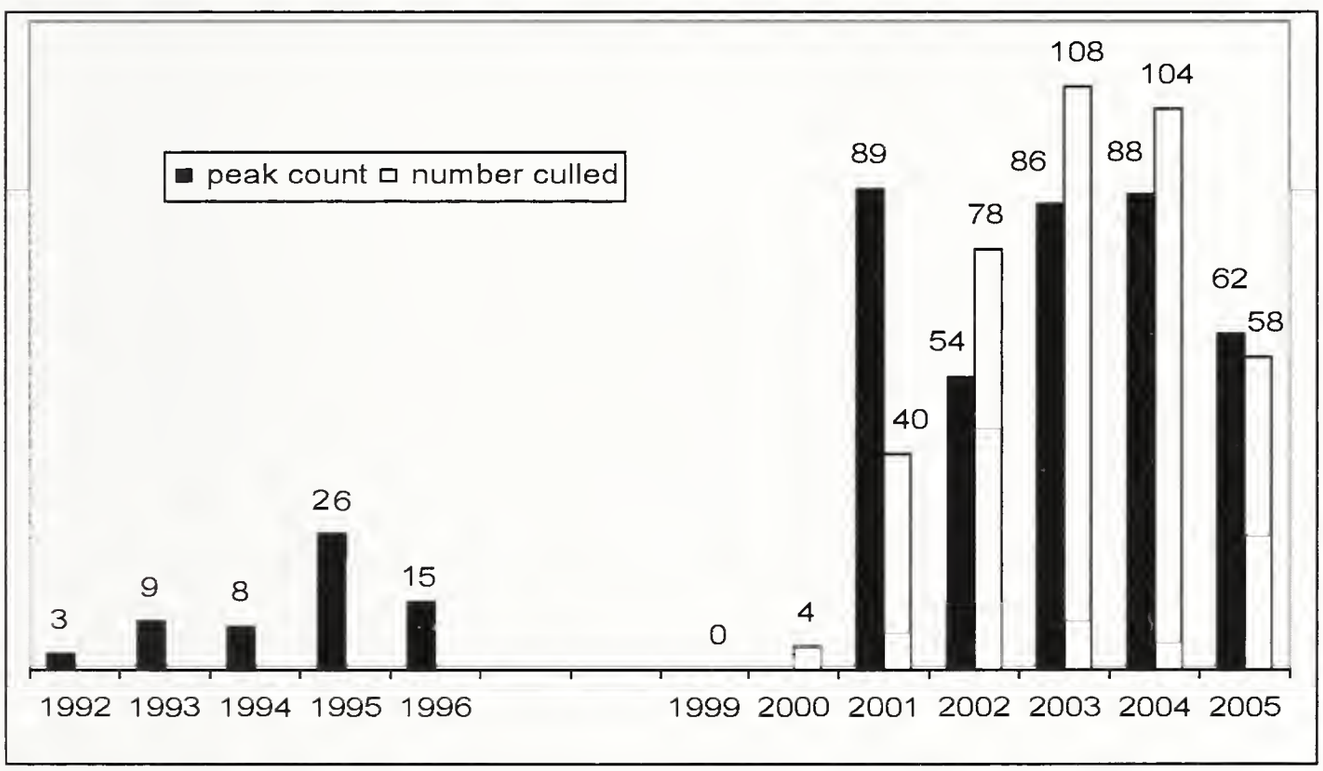

FIGURE 1. Peak counts and numbers of carrion crows culled in St James's Park.

I have traced no other relevant data for the park until my own observations began. From 1988 to 1994 numbers were small and stable averaging between 2.5 and 3.5 birds per count each year with maxima of between five and nine. Probably only one, or at most two, pairs nested in the park in this period. Larger numbers were first noted on 1 November 1995 when there were 25, with up to 26 in December. There were fewer in the following January, with numbers falling steadily until by April I noted only three birds, suggesting that the breeding population was still only a pair or two. Sanderson (pers. comm.) reported only a single pair nesting in 1995 and 1997. When I recommenced counting in 2001 there were already 32 by 2 August, but in January 2002 there was a record count of 89. Numbers were lower in August (33), but had increased again to 80 in October. Numbers have remained at similar levels since, but show considerable fluctuations from month to month and, to a lesser extent, from year to year. It is uncertain when culling commenced (no records

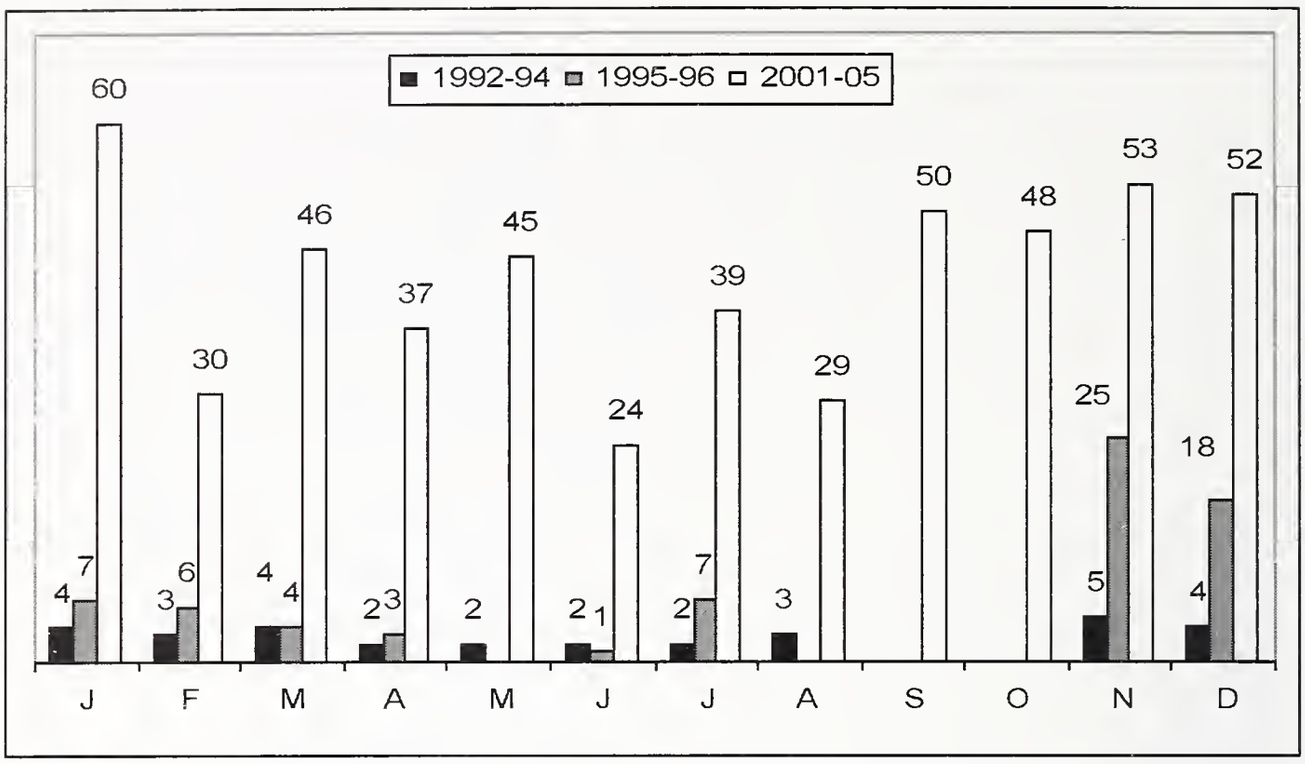

FIGURE 2. Mean of monthly counts of carrion crows in St James's Park.

are now available prior to 1999), but in the case of crows probably not until 2000, when four were killed. In the subsequent four years, however, between 40 and 108 have been killed each year, an average of 77 per annum. Peak counts and the numbers culled are depicted in Figure 1 and the mean monthly counts in Figure 2, though the high level of culling in recent years make it impossible to draw conclusions on the seasonal and annual variations in numbers. It is unfortunate that there are no counts between 1996 and 2001 when the build-up to the present numbers evidently occurred. I estimated there to have been about five pairs nesting in the park in 2004 and possibly as many as seven in 2005. The latter included two nests only twenty metres apart. This is not without precedent in inner London as England (1970) reported three nests (two in one tree) in Fitzroy Square which is only about sixty metres across. I made very few counts in Green Park. I saw just two or three crows there in June 1995 and on four dates (one in summer, the rest in winter) between December 2003 and December 2005, though there were nine there in January 2005.

The highest concentration of crows is consistently around the restaurant near the north-east shore of the lake. This is one of the areas favoured by the public for feeding waterfowl. Elsewhere crows are usually to be seen only as pairs or, in season, family parties or occasionally singly. The 'restaurant' flock is evidently composed mainly, if not entirely, of non-breeding birds. Both breeding and non-breeding birds appear to obtain most of their food by probing on the mown lawns, but since larger numbers have occurred they can frequently be seen exploiting the opportunities presented by people distributing food to birds. On land the species most often taking food, usually bread, are feral pigeons *Columba livia*, but can include wood pigeons *C. palumba* and occasionally in winter gulls *Larus* spp., as well as crows at any season and also, increasingly frequently, squirrels (see below). People will now frequently target crows as recipients of food, usually bread, but occasionally biscuits. At least one person did this on a regular basis in 2005. The crows did not take food from his hand, but when he appeared, he was immediately recognized by the crows, up to several tens of which followed him until he reached his regular feeding place and distributed bread to them. Once a crow obtained a piece of bread it normally flew off with it to consume it away from

the others. Thus far I have not seen crows approach nearer than about two metres from those offering food. Crows are, unsurprisingly, dominant over feral pigeons when competing for food, but their relationship with squirrels is ambivalent. Some crows will lunge at a squirrel and drive it off, but equally a squirrel may rush at a crow approaching a food item and the crow will back off. Crows will also exploit the squirrels' propensity to hide food. In December 2003 I saw a group of four crows standing watching a squirrel bury something in a lawn. When the squirrel departed two of the crows rushed forward and one of them dug up the food item (which I was unable to identify) and flew off with it. Crows will also occasionally compete with moorhens *Gallinula chloropus* when these join in the melee of birds being fed on the bank beside the lake. They are wary of them, but are more agile and thus sometimes able to obtain food before it is seized by a moorhen. Although crows readily take food from people, this is probably not a critical food source as on half of the occasions (seven out of fourteen) when I have noted the circumstances, they have been seen feeding only on the lawns although many people were present on those occasions feeding other birds and squirrels. Crows almost certainly at times roost in the park in the trees around the restaurant. About 30 were watched settling there at dusk on 19 October 2004 and a similar number likewise on 8 March 2005. On the other hand, on 5 December 2005 most of the crows left shortly after sunset and flew off west at treetop height (suggesting they were not embarking on a long flight). Possibly they were heading for the grounds of Buckingham Palace. A few birds remained in trees in the park and presumably roosted there.

Grey squirrel

The history of the grey squirrel in St James's Park is obscure. Fitter (1945) summarizes its rapid spread from Regent's Park, one of the original introduction sites where it was released between 1905 and 1907. By 1923 there were 250 in Regent's Park and 20 in Hyde Park and Kensington Gardens, but, as usual, there is no mention of St James's Park. Fitter reports that there was then a determined effort to eliminate grey squirrels and that 170 were shot in the four central parks (presumably therefore including St James's) in four weeks in 1937 and that in the following year just one was reported in Kensington Gardens. We can perhaps deduce, therefore, that by then there were none in St James's Park. I have found no other evidence of its numbers, or even confirmation of its presence, there between that time and 1980. Simms (1974) does not mention it amongst the mammals occurring there. Burton (1974) states that many of London's parks have 'one or more squirrels' and without referring to specific localities, that they were surprisingly tame, appearing 'at your feet as soon as you produce a bag of food'. Between 1980 and 1985 I rarely saw more than a single squirrel on any visit, the most being three on 11 November 1986. The LNHS mammal database (commencing in 1994) has records for the park only from 1994 to 1996 and for 1998 and 2000, all of which refer to just one or two individuals (C. Herbert, pers. comm.). In spite of this it was clearly well established before 1999 in which year as many as 96 were culled. In the seven years 1999 to 2005, 845 were killed in the park, an average of 121 per annum, with a peak of 218 in 2004.

It is difficult to make an accurate count of this species as it is frequently concealed within bushes and shrubberies and, provided sufficient counts are made, the best guide to its numbers in the absence of culling may be the maximum count made in each year. Nevertheless, this clearly seriously underestimates the true numbers, for in 2004 and 2005, the two years for which counts and the numbers killed are available, the latter exceeded the counts by factors of nine and three respectively (Figure 3). The counts alone show a five or six-fold increase between 1986 and the mid 1990s and a further 25 per cent increase in the following decade. While the counts can probably be

relied upon as an indication of the timing of the increase, the scale of that increase, given the numbers killed, is difficult to assess accurately, but it was clearly very substantial. Unsurprisingly, breeding evidently takes place in the park and in January 2006 I counted at least eight dreys there, though the number of dreys is not a reliable guide to the number actually breeding (Don 1985).

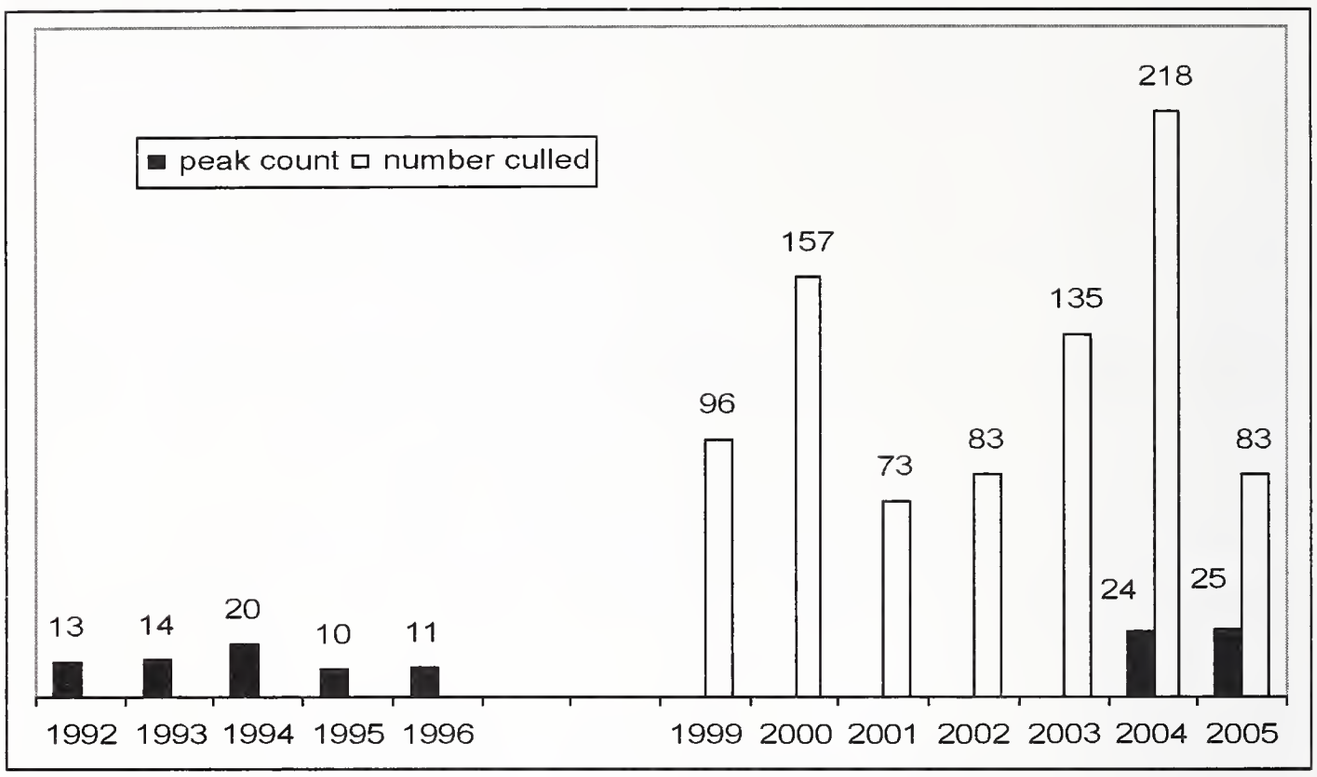

FIGURE 3. Peak counts and numbers of grey squirrels culled in St James's Park.

As already noted, with the disappearance of house sparrows a few of the men who fed them have transferred their attention to the squirrels and spend long periods on benches, armed with containers of nuts with which to attract the squirrels. These have become very tame and readily climb on to the benches (and the men) to obtain food. This tameness has encouraged the many other people that feed the birds to offer food (mainly bread) to the squirrels. It is now a common sight to see squirrels approach members of the public with bread and frequently attempt to jump on to them and try to snatch food from their hands. Some people evidently feed them on a regular basis and call them up from favoured shrubberies by whistling to them and offering food. Their relationship with crows is described above. They are more dominant over feral pigeons who readily give way to a squirrel if challenged by one.

Published data on grey squirrel dispersion refers to home ranges rather than density and these vary with season and the age and sex of the squirrel. Gurnell (1991) quotes range sizes of between 4.7 and 6.6 hectares between autumn and spring, but larger in summer. St James's Park covers about fourteen hectares excluding the lake, so at home ranges of those sizes the number of squirrels now occurring implies considerable overlap of range. This may be confirmed by the fact that up to three individuals can regularly be seen within a few metres of one another, with occasionally four or more within a few tens of metres.

Other species

Of the other species regularly taking food from the public in the park, feral pigeons have done so regularly for many years, but I have no data on their numbers. Wood pigeons will also do so, but generally in only small numbers and they tend to be more wary than feral pigeons, though Hewlett (2005)

reports them sitting on people's knees. Black-headed gulls *Larus ridibundus*, a non-breeding visitor, have for many years also regularly taken bread, but the herring gull *L. argentatus* has, until recently, shown no signs of doing so. In January 2005, however, four were taking bread thrown onto a lawn for feral pigeons and crows, but they were rather wary and soon flew off. Their behaviour was quite different from that of the black-headed gulls which normally take food from the air as it is thrown to them. Both Canada *Branta canadensis* and grey-lag geese *Anser anser* have been taking bread since at least the early 1980s (Oliver 1987), but in their case they take it mainly from the hand and will quickly approach people thought to be carrying food, and pull at their clothes. Even the appearance of a small notebook in the hand will be interpreted as food by geese and also by squirrels! Coots *Fulica atra* and the many waterfowl in the collection also of course regularly take bread, but apart from mallard *Anas platyrhynchos,* mostly from the water rather than on land.

The wider context

Before assessing the changes in St James's Park it is useful to consider changes elsewhere, especially in inner London. The course of the decline in the house sparrow in London has not been well documented. The best data come from counts in Kensington Gardens and a suburban garden survey (Hewlett 2002, Baker 2005). In Kensington Gardens the decline commenced in the first half of the twentieth century and although as many as 544 were counted there in autumn 1975, this had reduced to 81 a decade later, with just eight in 2000. In that year it finally disappeared from Holland Park (*Lond. Bird Rep.*). The decline in St James's Park thus occurred in parallel with that in both those inner London Parks. Since its inception in 1995 the Suburban Garden Survey, based on only a small sample, shows a steady decline in the number of gardens holding groups of 20 or more and an increase in the number no longer recording this species. Likewise the BTO's breeding bird survey recorded a 59 per cent decline in the London Area between 1994 and 2000 (Hewlett 2002).

In Kensington Gardens, Sanderson (1999) reported groups of 50 or more crows there since the mid 1960s. Relevant data on crows in inner London published in the *London Bird Report* is lacking until 1996, but there is evidence of an increase since then in Kensington Gardens where there were 54 non-breeding birds in June 1997 and 51 in September 1999, but as many as 142 in November 2000. In November 2005, however, there were only 99. Sanderson (1999) also states that two to three pairs nested annually in Buckingham Palace Garden between 1995 and 1997, with counts of 30 or more (maximum 38) regularly throughout that period. Subsequently, usually only a single pair bred there, but three pairs did so in 2001. In Regent's Park thirty pairs nested in 2001 and there were counts there of 96 that year and 100 in 2002 (Ducket 2002, 2003). Larger flocks reported elsewhere in inner London since 1996 have been at English Gardens, SE1 in November 1998 (196) and Victoria Park in 1999 (between 91 and 213) and in 2000 (124 in July). On the other hand, at Burgess Park there were up to *c.*90 and 100 in 1996 and 1997 respectively, but only up to 60 in 1998. In February 2005 I counted 83 feeding at low tide on the Thames foreshore opposite Battersea Park. Details of culling elsewhere have not been obtained, but in the Royal Parks (including those in outer London) up to 740 crows were killed annually between 1998 and 2001 (*Hansard* 2001). Elsewhere in England the carrion crow has increased in numbers since the beginning of the twentieth century, attributed primarily to reduced persecution (Brown and Grice 2005). These authors infer that this increase supported the spread into urban areas. In farmland and woodland Common Bird Census plots in the United Kingdom, density increased by 140 per cent between 1964 and 1978, but by only 10 per cent in the succeeding fifteen years to 1993 (Gregory and Marchant 1996). This levelling off could be a reflection of the population reaching the carrying capacity of those rural habitats, thus leading to an increase in the numbers moving to urban areas.

The early history of the grey squirrel in the Royal Parks has been discussed above, but evidence of its more recent status is scant. Simms (1974) did not list it for Hyde Park or Kensington Gardens, but reported that it had reappeared in Regent's Park in 1963 'after an absence of about 30 years'. In Buckingham Palace Garden it was absent in 1960 and 1961 (Sanderson pers. comm.). Herbert (1999) reported it as present there between 1995 and 1997, that it sometimes nested there and that interchange had been noted between there and Green Park. Subsequent counts include 15 in 1995 and eight in 2005 (Sanderson pers. comm.). The first recent record for Hyde Park was of a single 'scruffy tailless animal' in 1974 (Sanderson pers. comm.). Although there is no evidence in the LNHS mammal database of any increase elsewhere in inner London over the past decade (C. Herbert, pers. comm.), the *Hansard* report cited above discloses that up to 1,915 squirrels were culled annually in the Royal Parks (including those in outer London) between 1998 and 2001.

Discussion

In addition to changes in waterfowl (Oliver 1987), there have thus been significant changes in the populations of at least three other vertebrate species — the terminal decline of the house sparrow and the rapid increase in both crows and grey squirrels. All three species have exploited food available from the public, but it is not clear that this has been a significant factor in any instance. It self evidently was insufficient to prevent the loss of the sparrow population, the decline of which has yet to be fully explained. There is no evidence that it was in any way related to the increase in either crows or squirrels. The evidence in relation to crows is conflicting. While they take food regularly from the public, they were seen as often feeding solely from the lawns, suggesting that food from the public was not of major importance to them. On the other hand there are very few crows in Green Park, where feeding birds is a much less well-developed custom. This would suggest that there is indeed a link between the increase in crows in St James's Park and the availability there of artificial food. The increase in the number of people feeding crows may of course be as much to do with people's changing habits as those of crows. People have probably taken advantage of more, and tamer, crows as targets for feeding and the adaptability of crows in taking such food will have reinforced this. Whatever the effect on crows of feeding by the public, it is clear that the increase in St James's Park is part of a wider trend in inner London and beyond. If the supposition that rural habitats were approaching their carrying capacity by the early 1990s is correct, this could explain the timing of the observed increases in inner London. Given the large numbers killed in recent years, it is remarkable that both the breeding and non-breeding numbers have increased. The implication is that the park, along with other inner London Royal Parks where culling is carried out on a large scale, is effectively a population 'sink' and that there are a large number of crows in surrounding areas that move into the park to replace those killed. So long as culling continues at high levels, it will not be possible to assess the carrying capacity of the park for either breeding pairs or the non-breeding flock.

The effect of feeding on squirrels is also not clear. The ready supply of nuts throughout the year is a recent phenomenon and could have helped support an expanding squirrel population at those times of the year when natural food is in short supply. In any case, as already noted, squirrels also take bread of which there has been a plentiful supply for decades. As with crows, one should not overlook possible changes in behaviour by people, with the result that the offering of food by people and the seeking and taking of food by squirrels is a mutually reinforcing process. It seems likely, however, that their increase would have occurred anyway. The evidence suggests that it had been eliminated from all the central Royal Parks by 1937 or 1938 and, as noted, it did not reappear in Regent's Park until 1963. I have been unable to establish the precise date it

reappeared in St James's Park, but it was certainly there by 1980. As with crows, its rapid expansion in the face of such high levels of culling is remarkable and testament to its ability to exploit a vacant ecological niche. The fact that so many have been killed presumably indicates that, as with crows, there is a substantial surplus population elsewhere that rapidly moves into the park when numbers are reduced by culling. Repopulation will also, of course, have been aided by breeding of the remaining individuals. The absence of evidence of recent increases elsewhere in inner London therefore seems likely to be because of lack of recording rather than to a real lack of increasing numbers.

Finally, it is perhaps worth commenting on aspects of human behaviour revealed by this study. On the one hand there is evidently a substantial body of people who enjoy the wildlife of the park sufficiently to provide a plentiful supply of food. The tamer the animals become, the more attractive they appear to be to that segment of the public (which is by no means confined to the British; very many foreign visitors to the park are plainly attracted to squirrels, in particular). This contrasts with the desire to restrict numbers of common species where these are perceived to be in some way detrimental to human values. One final observation is perhaps worth making about naturalists. It is surely remarkable that over 200 squirrels can be killed in the park in a year, yet the LNHS database records a maximum of only one or two individuals there! Perhaps this is a wake-up call to observers to pay attention to and record the commonplace just as much as the unusual.

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Book review

Wild London: the nature of a capital. Written and photographed by Iain Green. Tiger Books (UK), Crowborough. 2005. Hardback. 176 pp. £25. ISBN 0 9543115 1 5.

The first thing that has to be said about this book is that, deplorably, it lacks an index. What there is at the back is a 'wild guide to London', a numbered map and list of forty-three sites selected from those mentioned somewhere in the book, but where? If you start at the front of the book in the usual way, and come to the first mention of 'the occasional parakeet' on page 46, how can you find out if there are pictures of these birds, other than by turning the pages hopefully until you get to the very good ones on pages 66–67? In general I think the photographs are better than the text, and I would have liked to see a note somewhere of the equipment used, presumably not digital in view of the acknowledgment for the diligent production of scans. There are daring pictures of dragonfly and cuckoo in flight, but the pictures of insects visiting flowers are less successful. On page 58 a fuzzy bumblebee is somewhere vaguely near a poorly displayed fritillary flower, and on page 97, a rather small bee is said to be collecting pollen from a perennial sow-thistle, which is actually a prickly ox-tongue.

The author looks young enough in his dust-jacket photograph for his English teacher still to be living. That person must have winced on seeing the 'peninsula' on page 125 turning into 'peninsular' five times over on page 126. The short paragraph on page 43 reads as though it is the visitors rather than the fox who blend into the background, then yawn and stretch. The content of the text is fine when it is about the experiences of producing the book, but there is too much I did not really want to read again, like the near-extinction of great crested grebes in 1860, and a lot more could have been done to give the peculiar flavour of the capital's natural history. Green tries to extrapolate from the 'wealth of insect life enjoying the flora of the Cabinet Office wildflower meadow' to roof gardens and window boxes which 'can, with the right planting, attract bees and other insects bringing life to the urban world', but can they really, on any significant scale? He is ignorant of the literature which shows how large an area is needed for any permanent insect populations to become established. He talks of fritillaries (flowers this time, not insects) as being 'now rare and only found in certain locations across London — Darlands Lake Nature Reserve, the London Wetland Centre and Camley Street Natural Park', but the last two fritillary sites have no more right to mention in a book on 'Wild London' than Holland Park or Sullivan Primary School in Fulham, if it still has them in its nature garden. 'The elusive and exotic bee-orchid survives in a few chalk downland sites in London', but bee-orchid sites in London now are less numerous on chalk downland than they are on urban waste ground, a habitat of which his book says nothing.

Enjoy this square book as a miniature coffee-table item, then, not as a valuable addition to the literature on London's natural history. It has certainly been well served by the designer Colin Woodman, who is thanked 'for enthusiastically turning my manuscript and photographs into a gorgeous book'. Note, for instance, how text has been superimposed over picture on page 17. Every page is an artistic composition.

RODNEY BURTON

Reoccurrence of the white sucker *Catostomus commersonii* in the River Gade (Hertfordshire)

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Summary

The North American white sucker *Catostomus commersonii* has only once been reported in open waters of Europe, and this was a single specimen found in the River Gade at Hemel Hempstead (Hertfordshire) in 1992. The species was not found again until 2004, when an additional seven specimens were found during routine and follow-up surveys. The circumstances of the original and recent reports of the species are discussed.

KEYWORDS: introductions, alien species, ornamental fishes, goldfish, ide, carp, parasites.

Introduction

The introduction of non-native species is of increasing concern to aquatic ecologists and naturalists (Copp et al. 2005*a*), especially releases of ornamental aquarium and garden fishes (Copp et al. 2005*b*). The first occurrence in Europe of white sucker *Catostomus commersonii* (Lacepède 1803), a North American catostomid that has been widely introduced in North America outside its native range (Pigg and Parham 1999, McPhee and Turner 2004), was a single specimen captured in the River Gade at Hemel Hempstead (Hertfordshire, England) in April 1992 (Copp et al. 1993). This fish was thought to be a one-off escapee from either a fish farm or a release from one of two garden centres located adjacent to the River Gade and upstream of the capture point. The aim of the present study was to report on the reoccurrence of white sucker, after a ten-year period of no reports, in this same stretch of river.

A species not normally associated with the ornamental fish trade, though used in North America as a bait fish (Gunderson and Tucker 2000, Rahel 2004), the white sucker was originally imported to Great Britain in small numbers along with goldfish *Carassius auratus* or tropical fishes up to the early 1990s. An importer and fish farmer situated on the River Gade, who found that white suckers would breed readily under outdoor fish farm conditions with little assistance (A. Scott, Cefas–Weymouth, pers. comm.), contacted Cefas (The Centre for Environment, Fisheries & Aquaculture Science) in the mid 1990s to discuss the possibility (and risks) of marketing the species in the UK to the ornamental fish trade. Legislation in force at that time, the Import of Live Fish Act 1980 (ILFA), did not prohibit the keeping or sale of white sucker. However, given the risk that escaped or released white sucker might breed in British waters, a precautionary approach was advised, and the commercial production and sale of this species, including the sale of existing

stock, was not pursued. During subsequent annual Cefas inspections of that fish farm, the species was not recorded (A. Scott, pers. comm.). Under subsequent legislation related to ILFA (The Prohibition of Keeping or Release of Live Fish [Specified Species] Orders, 1998 and 2003), a licence is required to keep or breed certain non-native fish species, including white sucker. The possibility exists that some specimens may have been sold to the general public prior to this advice and/or the enactment of ILFA, although no ILFA licences have ever been issued for this species (A. Scott, Cefas–Weymouth, pers. comm.).

Material and methods

Following the original report of white sucker in the Gade (Copp et al. 1993), routine electrofishing surveys of the river, using standard catch-per-unit-effort sampling (Murphy and Willis, 1996), were reinstated in 1998 on an irregular basis (Table 1).

TABLE 1. Date (day/month/year), location (National Grid Reference, NGR), fork length (FL) in mm and weight (Wt) in gm of white sucker captured in the River Gade, Hemel Hempstead, Hertfordshire (0°29′W/51°44′N), during routine Environment Agency of 100 m stretches (NGR given for u/s location of ≈ 100 m stretch) and commissioned surveys (*, Copp et al. 1993; †, undertaken by Bedwell Fisheries Services under contract to Cefas). All fish were estimated as age 2+ years except that of 14 April 1992, which was estimated as age 3+.

Date	Location	FL	Wt
14.iv.1992*	TL 044 061 (downstream of Dacorum College)	365	710
29.x.1998	TL 048 095 (Cura Fisheries)	—	—
26.ix.2000	TL 048 095 (Cura Fisheries)	—	—
3.x.2000	TQ 090 967 (Cassiobury Park)	—	—
12.ii.2002	TL 054 076 (Dacorum College) and TL 052 082 (Gadebridge Park)	—	—
28.ii.2002	TL 497 092 (Piccots End)	—	—
15.vii.2003	TQ 090 968 (Cassiobury Park)	—	—
21.v.2004	TL 026 124 (Great Gaddeston)	—	—
26.v.2004	TL 052 082 (Gadebridge Park)	282	362
"	" "	274	291
4.vi.2004	TL 054 076 (Dacorum College) to TL 497 092 (Piccots End)	—	—
17.vi.2004	TL 054 072 (Dacorum College) to TL 051 092 (lower Gadebridge Park)	239	153
"	" "	260	212
"	" "	265	220
"	" "	278	262
"	" "	282	361
7.vii.2004†	TL 054 076, TL 052 082, TL 051 086, TL 049 092	—	—
15.vii.2004	TL 079 020 (Kings Langley)	—	—
23.vii.2004	TL 044 697 (Cura Fisheries)	—	—
22.viii.2004	TQ 090 968 (Cassiobury Park)	—	—
2.xii.2005	TL 054 072 (Dacorum College) to TL 051 092 (lower Gadebridge Park)	—	—

Results and discussion

White sucker was not reported in subsequent surveys of the River Gade (Table 1) until two specimens were captured in May 2004 in an adjacent stretch of the river. Following a subsequent survey (4 June 2004), when no specimens were found, a further five white sucker were found in mid June 2004. Six of the seven fish captured in 2004 were males of estimate age 2+ years, except for one specimen of 3+. No further specimens were found during surveys in July and August 2004, nor in December 2005 (Table 1).

The reoccurrence of white sucker after more than ten years is perplexing. None of these fish were young-of-the-year, so successful natural reproduction does not appear to have taken place in the river proper. It is possible that these specimens derived from the original stock being held in private water bodies within the River Gade flood plain. Fish from these water bodies could find their way into the river during flood events, when connectivity to the river exists, or through unauthorized releases of excess stock. There are sections of the River Gade system, including a few backwaters areas, that have not been surveyed. This leaves the possibility of white sucker still being present in the system, which due to its variable discharge regime (i.e. occasional spates and floods) could allow fish movement both upstream and downstream.

The rarity of white sucker in the River Gade makes it difficult to assess potential fish disease and ecological impacts. Post-mortem examination of the seven specimens captured in 2004 revealed infestations that are common in free-living, native freshwater fishes of the British Isles: external — occasional occurrences of trichodinids on the skin and no visual gill abnormalities; internal — occasional-to-moderate infection by *Diplostomum* sp., and the occasional occurrence of *Pomphorhynchus laevis*, *Neoechinorhynchus rutili* and *Caryophyllaeides fennica*. Reported ecological impacts of white sucker introductions outside its native range in North America, e.g. the Rio Grande and Colorado River catchments, include displacement of native species (Saint-Jacques et al. 2000). Low frequency of occurrence of white sucker in the Gade also makes it virtually impossible to confirm the suggestion of Clover (2004) that white sucker may occupy, or compete for, the same niche as native fish species. In the 2004 surveys, the native fish species encountered were: barbel *Barbus barbus* (L.), bleak *Alburnus alburnus* (L.), common bream *Abramis brama* (L.), chub *Leuciscus cephalus* (L.), dace *L. leuciscus* (L.), gudgeon *Gobio gobio* (L.), minnow *Phoxinus phoxinus* (L.), roach *Rutilus rutilus* (L.), tench *Tinca tinca* (L.), brown trout *Salmo trutta* L., perch *Perca fluviatilis* L., bullhead *Cottus gobio* L., eel *Anguilla anguilla* (L.), stone loach *Barbatula barbatula* (L.) and threespine stickleback *Gasterosteus aculeatus* L.

Available habitat in the River Gade resembles that described for white sucker in its native range (e.g. Scott and Crossman 1973). For example, in streams of Colorado, adult white sucker prefer low-to-moderate water velocities and are found in pools and runs, with particular preference for rip-rap banks, bridge abutments, boulders, and undercut banks. Younger white sucker, less than about 12 cm total length, inhabit backwater areas, runs and riffles with moderate water velocities (Propst 1982). Stretches of the River Gade where white sucker were found include semi-natural (upstream) and partially-channelized (downstream) sections. The semi-natural section consisted of riffle/run sequences, with the occasional pool and concrete weir; the river bottom consisted mainly of pebbles and sand overlain by fine silt and mud, and water velocity varies from nearly stagnant to moderate velocity (> 10 cm s^{-1}). This upstream stretch was densely vegetated during summer, with limited areas of open water, in particular the section that passes through a public park. The downstream section was characterized by intermittent, sloped and vertical (concrete) walled banks, with substratum of sand, silt and some gravel. Similar to native species like roach and chub, white sucker tolerates a wide variety of conditions, and it is often the predominate fish species in stretches of water

course with elevated levels of domestic sewage effluent (Propst 1982). Indeed, dietary plasticity, with specialization on either benthic (Chironomidae, Mollusca, Trichoptera, Entomostraca), including detritus (Fisher et al. 2001) or zooplankton (Cladocerans) prey, especially the largest individuals, is a key aspect of the species' invasive character (Saint-Jacques et al. 2000). A similar assortment of benthic invertebrates was found in the gut of the white sucker taken from the River Gade in 2004.

The white sucker spawns on open substratum (Jones et al. 1999), such as found in the River Gade; the species is also known to undertake considerable movements (Jackson et al. 2001) and it has been found to breed successfully in the UK (albeit in outdoor fish-rearing facilities). This suggests that there is an elevated risk of the species establishing in the wild and justifies the need for the intensive surveys in 2004, as well as in the future, to ensure that no white sucker are allowed to remain in the River Gade. During these surveys, specimens of other non-native fish species were also captured in the River Gade, in particular in the stretches that pass through public parkland. In June, this included a golden orfe *Leuciscus idus* (292 mm fork length, FL) and a goldfish (127 mm FL). In July, this included three golden orfe (100, 105 and 157 mm FL), one goldfish (680 mm FL) and one common carp *Cyprinus carpio* (mirror variety: 8.8 cm FL). This suggests that the release (by the general public) of aquarium and garden pond fishes to the wild is not restricted to ponds, which in Epping Forest (Essex) have been found to have increased abundance and numbers of varieties of non-native fishes (especially goldfish) during the 1990s (Copp et al. 2005*b*).

In conclusion, the Import of Live Fish Act 1980 has lead to the development of a regulatory process whereby existing sites containing non-native fish and new sites proposed for introductions are assessed for their potential for fish to escape to rivers and flood plains. The occurrence of white sucker in the River Gade demonstrates that the holding of non-native fish species represents an ongoing risk and that regulation has only been partially successful. This highlights the need for more vigilance in the monitoring of river systems, further investigation of potential impacts, greater liaison with the public and fishery managers on the risks of releasing non-native species into the wild, and greater enforcement of the ILFA legislation to provide better protection of the wider environment.

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Book review

Ants of Surrey. John Pontin. Surrey Wildlife Trust. Pirbright, Woking. 2005. 87 pp., 16 col. pl. ISBN 0 9526065 9 3. £14.00, plus £2.40 p. & p. to Atlas Sales, Surrey Wildlife Trust, School Lane, Pirbright, Woking, Surrey GU24 0JN.

This is the ninth volume in this series on the wildlife of Surrey, based around a set of tetrad distribution maps, in this case of records made since 1984. Older records are mentioned where appropriate, and show up on the maps of species that have much declined.

This is quite the boldest undertaking in this series to date. Even our small British fauna of ants includes species complexes that have been subdivided only recently and provide a challenge to any inexperienced identifier. John Pontin provides a simplified key to the workers of the thirty-two species that breed in Surrey, out of the current resident British fauna of forty-two. As the novice collector is likely to add new information on the distribution of the more obscure subterranean species by casual collection of the winged males and females, the restriction to worker keys may result in some lost opportunities.

There is a well-chosen introduction to the habitats and biology of ants. Collection and preservation of specimens for identification and maintenance of captive colonies are treated succinctly.

Text on the individual species begins with a statement of status in Surrey and mention of the size range of the species. Identification characters are discussed, as are habitat specializations which will aid in locating nest sites (much the most reliable way of detecting the more secretive subterranean species). The distribution maps show how many species of ants are restricted to the hot, early succession habitats provided by the varied heaths of west Surrey, but the author recognizes that myrmecological effort is biased towards that area, leading to probable under-recording of soil-dwelling species in the east of the county.

The sixteen colour plates illustrate typical eggs, larvae, pupae and adult ants, a selection of nests and of habitat successions. The remainder are attempts to give photographic alternatives to the drawings of morphological characters found in other keys. I do not find the photographic attempts to figure such details as the scapes of *Myrmica* species any more successful than the usual line drawings. Scanning electron micrographs are required to get the necessary depth of field. A set for each species taken from two or three angles is essential for proper comparison of features that show best at different angles for the various species.

The book concludes with some other essential information: notes on identifying the other 11 species found in the south of England, but not yet in Surrey; likely future expansions of range and extinctions; a selection of sites of greatest interest in Surrey for their ant faunas; a glossary and a bibliography. The index to species includes a section on myrmecophiles that are mentioned in the text.

This excellent distillation of John Pontin's lifetime experience of Surrey ants should be in the hands of all habitat managers to inform them about these important and dominant soil insects. Hopefully it will also inspire a new generation of myrmecologists. Membership of the Bees, Wasps and Ants Recording Society is however a desideratum to locate an expert to help the beginner to identify these insects.

RAYMOND UFFEN

Bird predation on Turkish crayfish in central London

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Summary

During autumn and winter 2005–6 grey herons *Ardea cinerea* and lesser black-backed gulls *Larus fuscus* feeding on the Serpentine and the Long Water were noted with unusual catches. The prey was later identified as Turkish or thin-clawed crayfish *Astacus leptodactylus* Eschscholtz, 1823. In June 2006 three hot still days caused oxygen depletion in the water, driving many crayfish to the margins where they were taken by carrion crows *Corvus corone corone* and other birds. During July and August great crested grebes *Podiceps cristatus* were seen catching crayfish in these waters.

A few illustrations are shown here, together with background information about this crayfish species, an introduction to Britain.

Background

Crayfish are culinary delicacies, of which the finest is said to be the noble crayfish *Astacus astacus* from northern Europe, although formerly the native British white-clawed crayfish *Austropotamobius pallipes* (Lereboullet 1858) was much esteemed. The latter species is now fully protected in England. However, the thin-clawed Turkish from south-eastern Europe and the signal *Pacifastacus leniusculus* (Dana 1852) from America are larger and more prolific, and favoured by restaurateurs who have encouraged their importation and cultivation in this country. Both have now spread into natural habitats across Europe (Souty-Grosset et al. 2006), in many places ousting the native species. The signal is also notorious in being a carrier of the crayfish plague organism, which is lethal to all European crayfish, but the Turkish is also invasive and adapts well to the eutrophic waters of urban lakes. Twenty years ago several colonies were known in the London area, in ponds on Clapham Common and Hampstead Heath (Ingle and Clark 1989). It is known to have been imported for the restaurant trade since the early 1970s, and to occur in a number of lakes and ponds around London, including the Serpentine, while a population believed to have originated from Billingsgate fish market is now the dominant invertebrate in some forty kilometres of the Grand Union Canal (Holdich and Reeve 1991).

Unlike the native white-clawed crayfish, Turkish crayfish are active both by day and night (Ingle and Clark 1989), and individuals up to 500 g have been captured on rod and line (Holdich and Reeve 1991).

Crayfish are also desirable prey. As juveniles, they are vulnerable to some invertebrate predators and are taken by trout, eels and perch, while adult crayfish are an important food source for otters and to some extent for mink. However, the role of birds as predators has been less noted, particularly in Europe (Hogger 1988).

The Serpentine and Long Water crayfish

Whatever its origin, by 1994 the population of Turkish crayfish in the Serpentine had matured sufficiently to be commercially harvested for restaurants. This continued until 1999, when, due to problems with oxygen levels in the water, there was a dramatic fall in numbers. In 2000, a biological regeneration treatment, developed by Penergetic International of Switzerland, commenced on the Serpentine. It has resulted in clearer water, less sediment

and reduced algal levels. This might have made conditions less favourable for the crayfish and also increased visibility to predators, but observations have shown that there are still plenty of them about.

Attention was attracted to these crayfish on 9 October 2005, when a young heron was noted wading slowly along the Serpentine's east shore, peering intently into the shallow water and occasionally stabbing at it. When a small, frantically struggling crayfish was captured a picture was taken (Figure 1), which enabled the prey to be identified. Subsequently, similar scenes were noted from time to time, but not close enough to photograph.

FIGURE 1. Young heron with small crayfish by east shore of the Serpentine, 9 October 2005. *Photo: Elinor Wiltshire*

On 22 December, a lesser black-backed gull swooped down on shallow water near the boatstage, bringing its prey ashore to dismember (Figure 2) under the envious eyes of a watching crow. It was clear from crayfish remnants scattered on the path edge that this was a regular feeding ground. Although there are few of these gulls on the Serpentine (three pairs were noted during spring 2006), they are confident and successful crayfish hunters. During 2005 a pair nested on the Long Water, and raised one offspring which was regularly seen in the Peter Pan area. On 20 December this young bird, swimming near the Fountains, snatched a small crayfish and flew with it to a raft of thin ice, where it proceeded to eat it.

FIGURE 2. Lesser black-backed gull with crayfish near boatstage, 22 December 2005.
Photo: Elinor Wiltshire

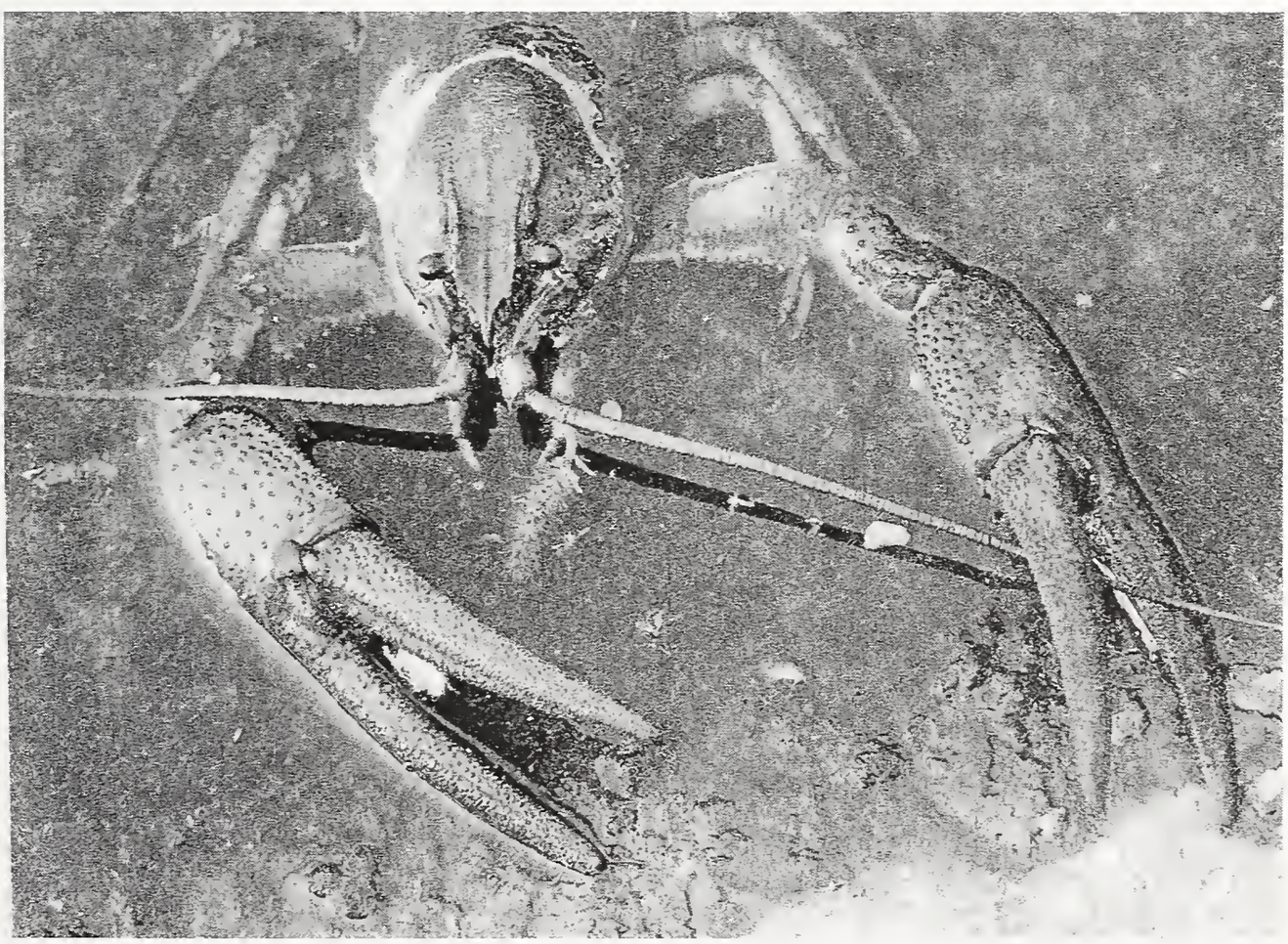

FIGURE 3. Crayfish struggling for oxygen, 18 June 2006. *Photo: Elinor Wiltshire*

On 17–19 June 2006, when exceptionally hot still days depleted oxygen levels in the Serpentine, numerous crayfish came to the surface and struggled in distress to the margins (Figure 3), where most were taken by lesser black-backed gulls, carrion crows and other birds.

During July and August, great crested grebes were frequently seen catching crayfish (Figure 4) to feed themselves and their families.

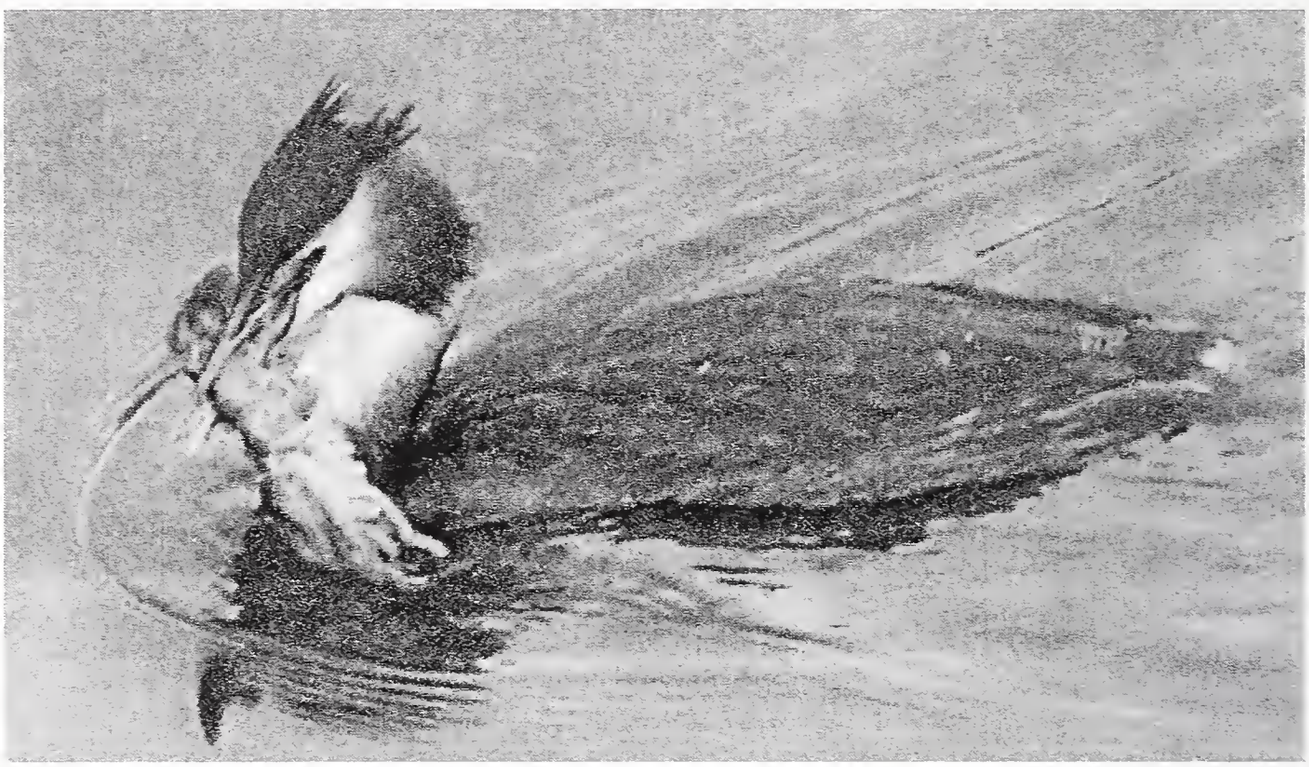

FIGURE 4. Great crested grebe with crayfish near bridge, 24 July 2006.
Photo: Elinor Wiltshire

Waterfowl are plentiful on the Serpentine and the Long Water for a great part of the year, and other bird species — in particular cormorants *Phalacrocorax carbo* — may feed also on crayfish. However, this study is restricted to examples which came within camera range.

Acknowledgements

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Ecology and distribution of the two-lipped door snail *Balea biplicata* in Britain

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Summary

Although common and widespread in mainland Europe, the two-lipped door snail *Balea biplicata* is rare in Britain and declining, being known only from a handfull of sites along the Thames. Surveys to understand why the species is so rare found that it inhabits a broad range of common habitat types. It is hypothesized that dispersal limitation and lack of available habitat may explain the species' rarity. Recommendations to improve the conservation status of *Balea biplicata* are described.

Introduction

The two-lipped (or Thames) door-snail *Balea biplicata* has a very restricted distribution in the UK. A recent non-marine molluscan atlas (Kerney 1999) only shows records along the banks of the River Thames within the Greater London area although there are old records from Bristol, Cambridge, Purfleet (Essex), Leckhampton (Gloucestershire), Tring Park (Hertfordshire), Winscombe (Somerset), Haslemere (Surrey) and Easton Grey, Alderbury, Clarendon, Roundway, Devizes and Durnford (Wiltshire) (Boycott 1929). *Balea biplicata* (referred to in some texts as *Clausilia* or *Lacinaria biplicata*) is listed as category 3: 'rare' in the UK *Red Data Books* (Bratton 1991). Failure to relocate the snail in some of its old localities has prompted fears of a decline. It features in the London Biodiversity Action Plan (BAP) where it is described as a flagship species in the Tidal Thames Habitat Action Plan. It has been argued that British specimens dating to the Bronze Age indicate native status (Castell 1962), although Kerney (1999) dated the earliest examples as Roman and considered that 'its synanthropic habit suggests it may be an old, accidental introduction'. Kerney and Cameron (1979) state that *B. biplicata* is probably spread by man in parts of the range (including southern England).

FIGURE 1. *Balea biplicata.*

B. biplicata measures 11–14 × 4 mm, and is easily overlooked (Figure 1). Early writers tended to associate it with willow trees in damp or marshy places, although a reassessment of the three sites known to Boycott (1929) found that two of the sites were distinctly dry and one frequently wet

(but not marshy). The main features they had in common were judged to be a calcareous soil and a more or less artificial character. More recently, however, the London BAP associates *B. biplicata* with riverbank habitats, typically in the upper intertidal area among litter within flood meadows and scrub.

We examined one of its current strongholds at Occupation Lane in Kew, London, a 'Site of Borough Importance — Grade 1' (SBI). The SBI is now protected as a 'Snail Reserve' within the new Kew Riverside Development, constructed by housebuilder St George West London. The SBI is a seemingly ordinary secondary woodland dominated by sycamore *Acer pseudoplatanus* over a field layer dominated by ivy *Hedera helix*. This is a vegetation type that occurs very widely across much of Britain. Boycott's (1929) study also reported *B. biplicata* from common and widely distributed habitats. So why is *B. biplicata* not more widespread? We decided to investigate some of the potential factors limiting its distribution. Our findings, set out below, are followed by a discussion of conservation measures likely to benefit the species.

Objectives and methods of the survey

Based on a study of the literature, discussions with local naturalists and our own investigations, we identified several London sites where *Balea biplicata* had been recorded or where we considered that suitable habitat might be present. The study sites and brief descriptions are listed in Table 1.

At each site, *B. biplicata* was systematically searched for by hand amongst vegetation and debris within 0.25 m^2 quadrats, and numbers of this and other molluscs were recorded. The environment of the quadrats was characterized by recording the amount of woody and rubble debris (scored as absent, <5%, 5–20%, 21–50% and >50%). Substrate pH and the extent of tidal influence (never inundated, occasionally inundated and regularly inundated) were also recorded for each quadrat. The surrounding vegetation was recorded within larger NVC quadrats (Rodwell 1991–2000) and centred on the smaller snail quadrats within. The mean Ellenberg values (Hill et al. 1999) for soil reaction or pH (R), nutrients (N), moisture (F) and light (L) were calculated (unweighted by Domin value) for each quadrat irrespective of *B. biplicata* presence or absence. *B. biplicata* absence or presence/abundance was then compared in relation to the environmental variables recorded and the mean Ellenberg values used to characterize the environment of each quadrat. Based on our initial assessment of the Occupation Lane site (Site 9) and the work of Boycott (1929), *B. biplicata* presence and numbers were also investigated in relation to the amount of ivy cover.

Results of survey

Of the fourteen sites surveyed, eight supported *Balea biplicata*. All were already known to have supported the species. Despite apparently similar habitats and, in some cases, close proximity to known sites, no new populations were found.

Habitat types where *B. biplicata* was found in greatest abundance were generally on moist soils in large stands of sycamore or ash *Fraxinus excelsior* woodland, with dense ivy ground cover. The maximum *B. biplicata* count from this habitat type was sixty-seven specimens from one quadrat at the Snail Reserve at Occupation Lane SBI (Site 9). *B. biplicata* was, however, recorded in lower numbers in other woodland habitats, in stands of tall herb on drier soils, and in habitats dominated by willow *Salix* and wetland vegetation, and subject to frequent inundation. *B. biplicata* was also found amongst ground cover in 'linear habitats' such as the hedgerow along Occupation Lane in Kew (Site 10) and tree lines adjacent to the Thames Path (Sites 7 and 8). Soil pH from *B. biplicata* sites ranged from 5.8–7.1.

TABLE 1. Sites surveyed for *Balea biplicata*. The asterisk denotes Sites where the species is already known.

Site No.	Location and Grid Reference	Description
1*	Isleworth Ait. TQ167759	A large island within the Thames supporting mature secondary woodland dominated by sycamore, poplar and ash. Marshy mud flats at the fringes of the Ait support osier beds. The whole island is subject to occasional inundation at spring high tide.
2	Thames Bankside; Richmond Old Deer Park TQ168755	Overlooks Site 1. The Thames bank is wooded with sycamore and ash and a well-developed understorey. To the east is Richmond Deer park, separated from the sample area by woodland and a wide wet ditch.
3	Thames Bankside; Richmond Old Deer Park TQ168758	As Site 2, approximately 300 m downstream along the Thames bankside. Overlooks Site 1.
4	Syon Park Tidal Flood Meadows SSSI. TQ170763.	West bank of Thames 150 m downstream of Site 1. Sampled area ranged from wet flood meadows punctuated by muddy gullies to dry broadleaf woodland dominated by sycamore.
5*	Ferry Quays, Brentford. TQ181775.	Intertidal inlet opposite Lots Ait within new residential development. Inlet modified and increased in size as part of the surrounding residential development to benefit *Balea biplicata*.
6*	Lots Ait, Brentford. TQ182775.	Island within the Thames supporting secondary sycamore woodland and former boatyard.
7*	South bank of Thames, West of Kew Bridge. TQ195775.	Tree line and scrub 30 m west of Site 9.
8*	South bank of Thames, East of Kew Bridge. TQ195773	Adjacent to wooded eastern railway embankment, 15 m west of Site 9. Nettles and scrub adjacent to wooded railway embankment, separated from woodland by a tarmac road.
9*	Occupation Lane SBI 'snail reserve'. TQ196773	Secondary woodland, dominated by sycamore with bramble and elder understorey, and dense field layer.
10*	Occupation Lane, Kew. TQ194772	Hedge adjacent to Occupation Lane and residential gardens, south of Site 9. Hawthorn with ivy ground cover.
11	Thames bankside (south bank), west of Chiswick Bridge. TQ201764	Beside Thames. Thin strip of woodland on thin soils/bare brick. Understorey and ground flora well developed.
12	Thames Bankside (north bank) west of Barnes Bridge. TQ210762	Sycamore dominated woodland adjacent to Thames path. Well-developed understorey and field layer.
13	Thames Bankside (north bank) west of Barnes Bridge. TQ212762.	As Site 12, approximately 200 m downstream along the Thames bankside.
14*	Duke's Hollow Local Nature Reserve, west of Barnes Bridge. TQ213763	A broadly bowl-shaped depression on the Thames bank. The upper slopes support sycamore woodland, further down are willows and wetland vegetation which is inundated at high tide.

B. biplicata was found in association with, i.e. in the same quadrat as, nineteen other mollusc taxa, with *Oxychilus* sp. and *Trichia striolata* being the most frequent (79% and 74% of quadrats respectively). The list of mollusc species recorded in association with *B. biplicata* is presented in Table 2. The German hairy snail *Perforatella rubiginosa* was found at Syon Park SSSI (Site 4) and at Ferry Quays (Site 5) where *Balea biplicata* was also found, but not within the same quadrat. This species is of particular note, it being listed as category 2: 'vulnerable' in the UK *Red Data Books* (Bratton 1991).

TABLE 2. Other mollusc species recorded from the nineteen 0.25 m^2 quadrats containing *Balea biplicata*.

Species	Number (and percentage) of quadrats from which recorded (maximum = 19)
Oxychilus sp.	15 (79%)
Trichia striolata	14 (74%)
Cochlicopa lubrica	7 (37%)
Arion hortensis	6 (32%)
Cepaea hortensis	6 (32%)
Discus rotundatus	5 (26%)
Oxyloma pfeifferi	4 (21%)
Vitrina pellucida	4 (21%)
Deroceras reticulatum	3 (16%)
Hygromia cinctella	3 (16%)
Vitrea crystallina	3 (16%)
Ena obscura	2 (11%)
Zonitoides nitidus	2 (11%)
Arion ater/lusitanicus	1 (5%)
Deroceras laeve	1 (5%)
Helix aspersa	1 (5%)
Lymnaea peregra	1 (5%)
Lymnaea truncatula	1 (5%)
Punctum pygmaeum	1 (5%)

B. biplicata presence or absence in relation to tidal influence, amount of debris (woody and rubble) and cover of ivy are shown in Figures 2 to 5. No evidence was discovered of an association between *B. biplicata* presence and tidal influence or level of cover in any of the quadrats ($p > 0.05$, chi-squared test, combining categories where possible when expected numbers were low), but in some cases it was not possible to test this statistically owing to small sample size. Although the amount of ivy cover was not associated with presence or absence of *B. biplicata*, an analysis restricted only to quadrats containing *B. biplicata* found significantly lower numbers of snails (oneway ANOVA, $p = 0.001$) in the low ivy cover category (Domin 1–4) compared to higher cover categories (Domin 5–7 and 8–10) which did not differ significantly from one another. Similar ANOVAs were performed for tidal, woody debris and rubble categories, but no significant differences were found.

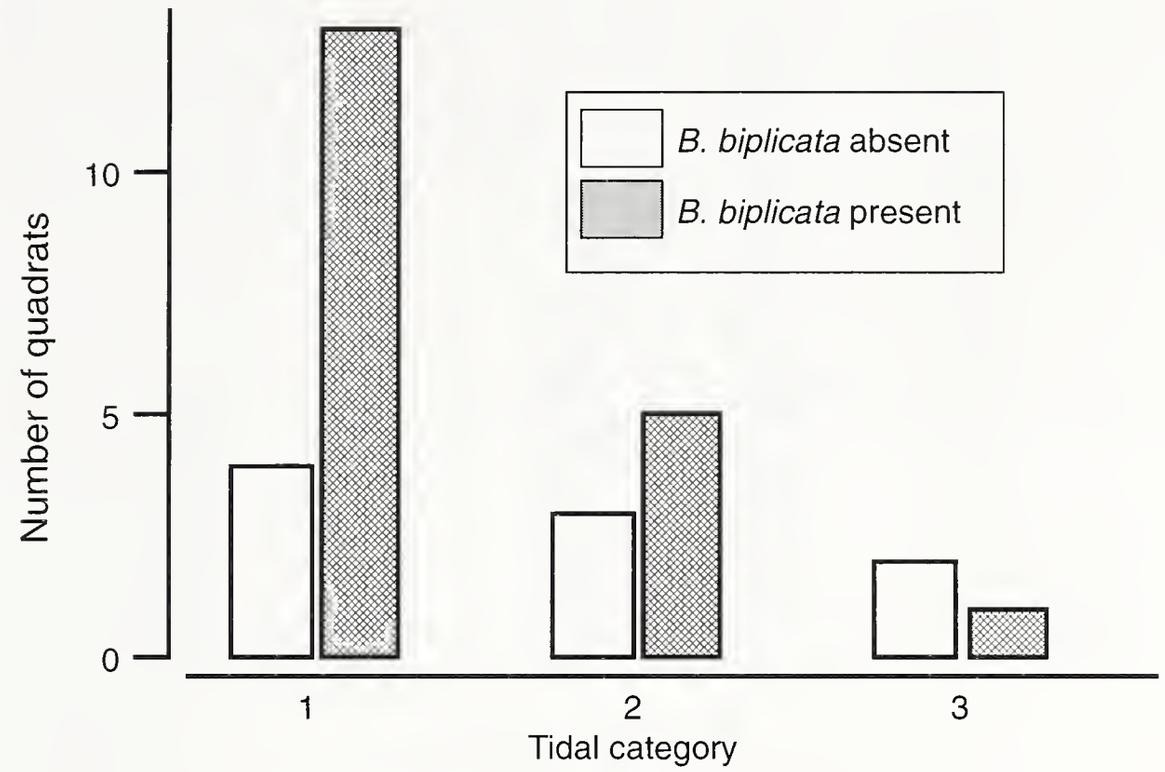

FIGURE 2. *Balea biplicata* presence/absence in relation to tidal influence. (Category 1 = never inundated at high tide, 2 = occasional inundation, 3 = often inundated).

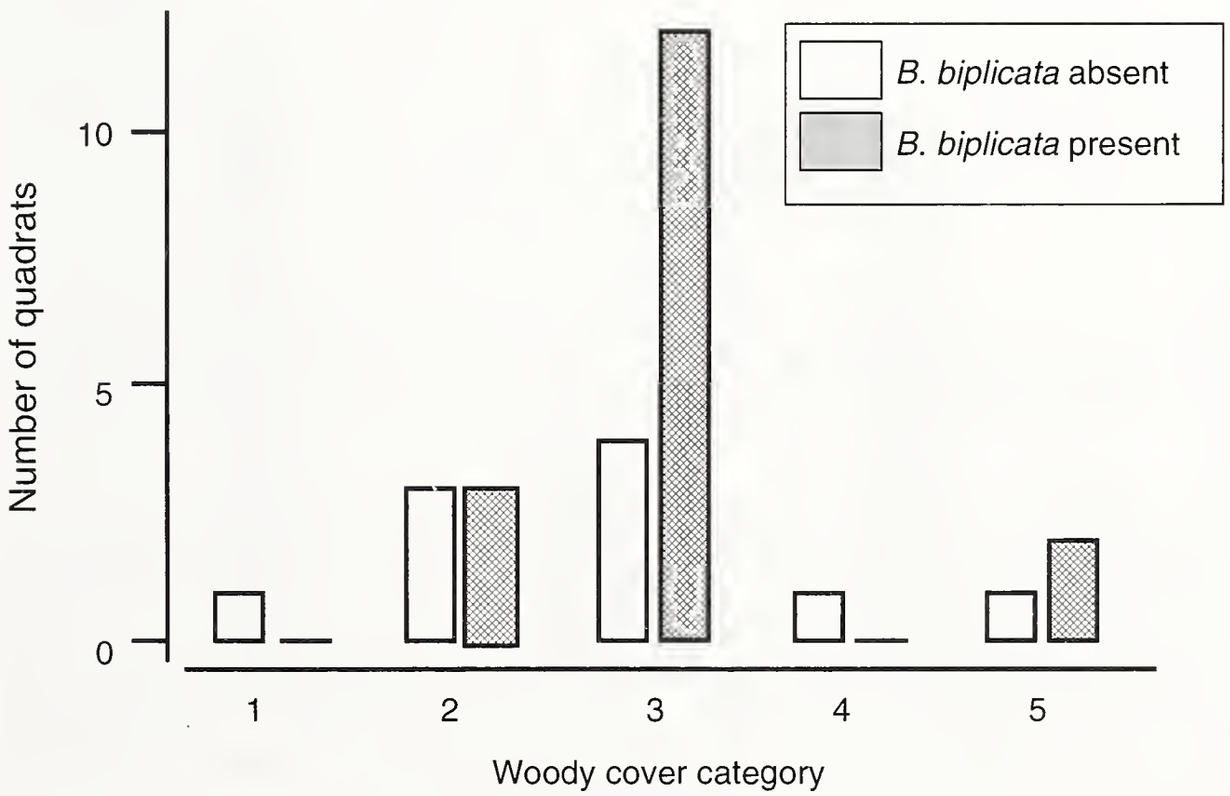

FIGURE 3. *Balea biplicata* presence/absence in relation to woody cover (Category 1 = absent, 2 = < 5% cover, 3 = 5-20% cover, 4 = 21-50% cover, 5 = > 50% cover).

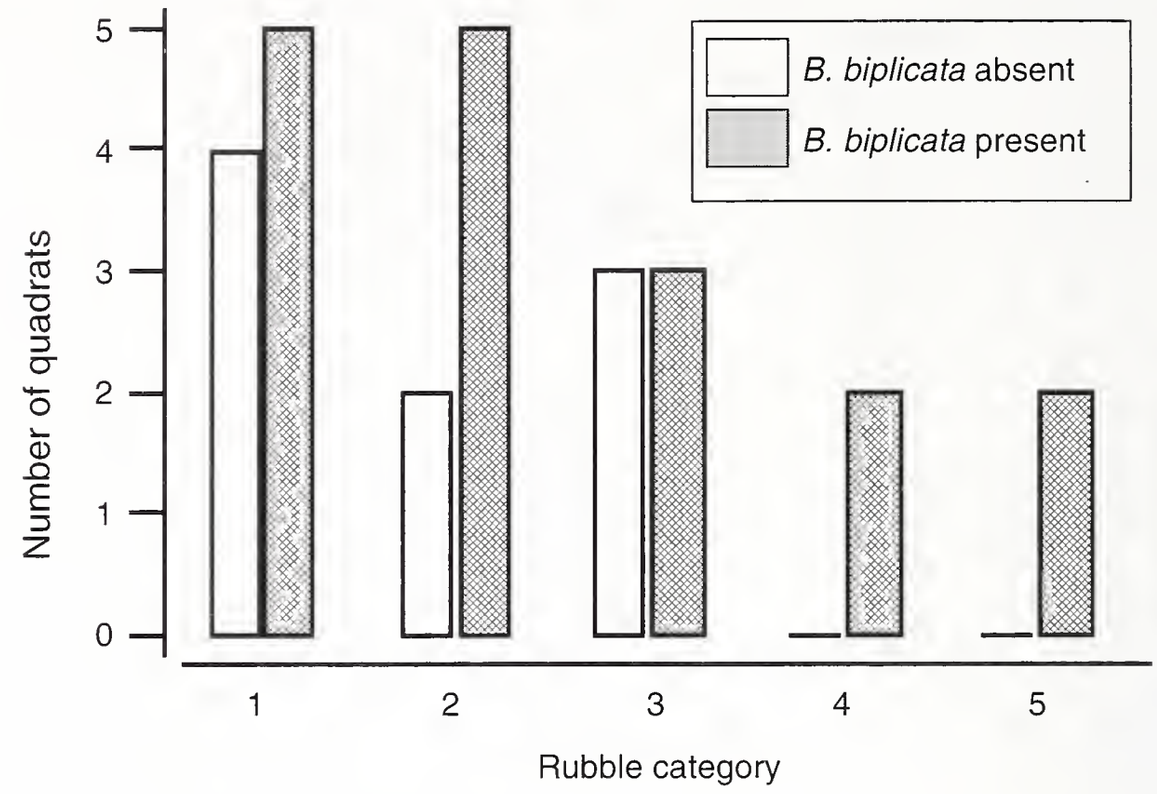

FIGURE 4. *Balea biplicata* presence/absence in relation to amount of rubble (Category 1 = absent, 2 = < 5% cover, 3 = 5–20% cover, 4 = 21–50% cover, 5 = > 50% cover).

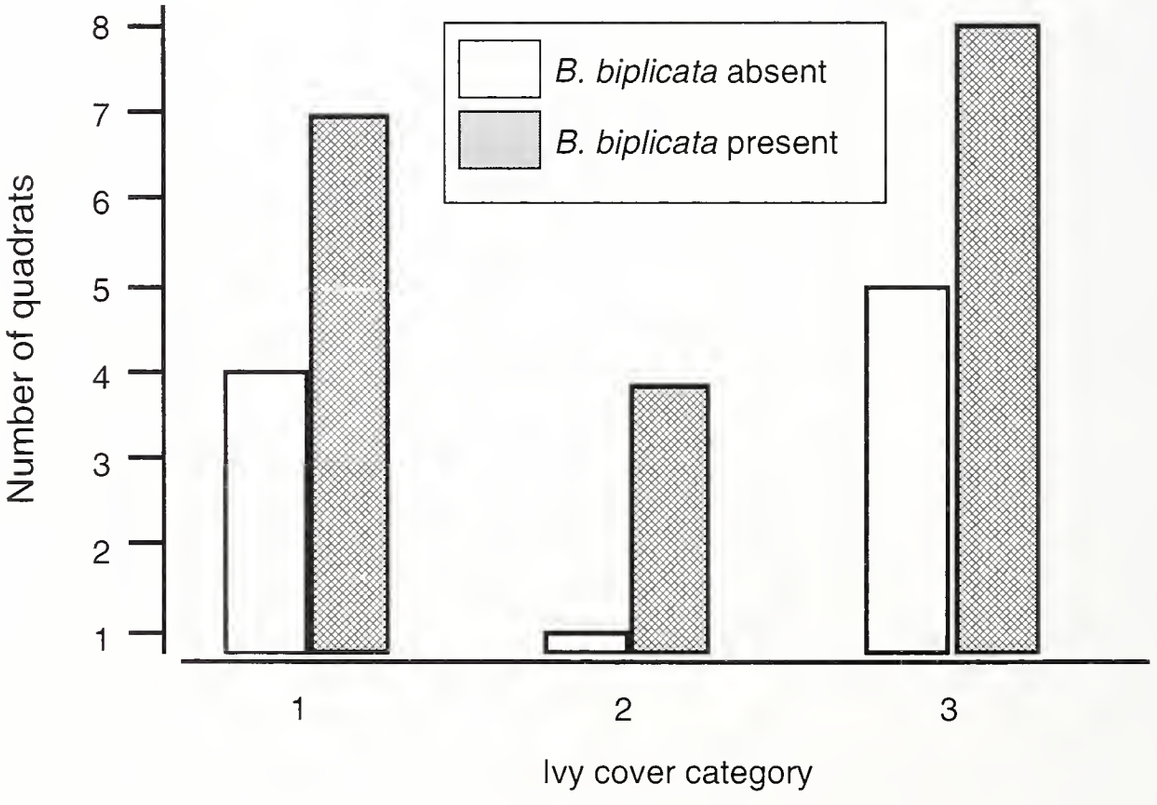

FIGURE 5. *Balea biplicata* presence/absence in relation to ivy *Hedera helix* cover (Category 1 = domin value 0–4, 2 = domin value 5–7, 3 = domin value 8–10)

Figure 6 shows the 'position' of the quadrats relative to one another in terms of the mean Ellenberg values using principal components analysis. The axes of the diagram are derived from the environmental variables that were measured, but reflect different combinations of those variables in such a way that maximizes the 'spread' of quadrats on the graph, subject to certain statistical constraints. It suggests that some study sites may lack *B. biplicata* as a result of unsuitable conditions. The snail is absent from the quadrats occupying extreme points on both axes — unlikely to be the result of chance. But there are other quadrats that lack *B. biplicata* although appearing suitable in terms of this analysis, because they are situated close to the quadrats that do contain the snail and are therefore similar in terms of the environmental variables that were measured. And if our small sample contains a few examples of suitable habitat it is inevitable that there must be many other examples that were not investigated.

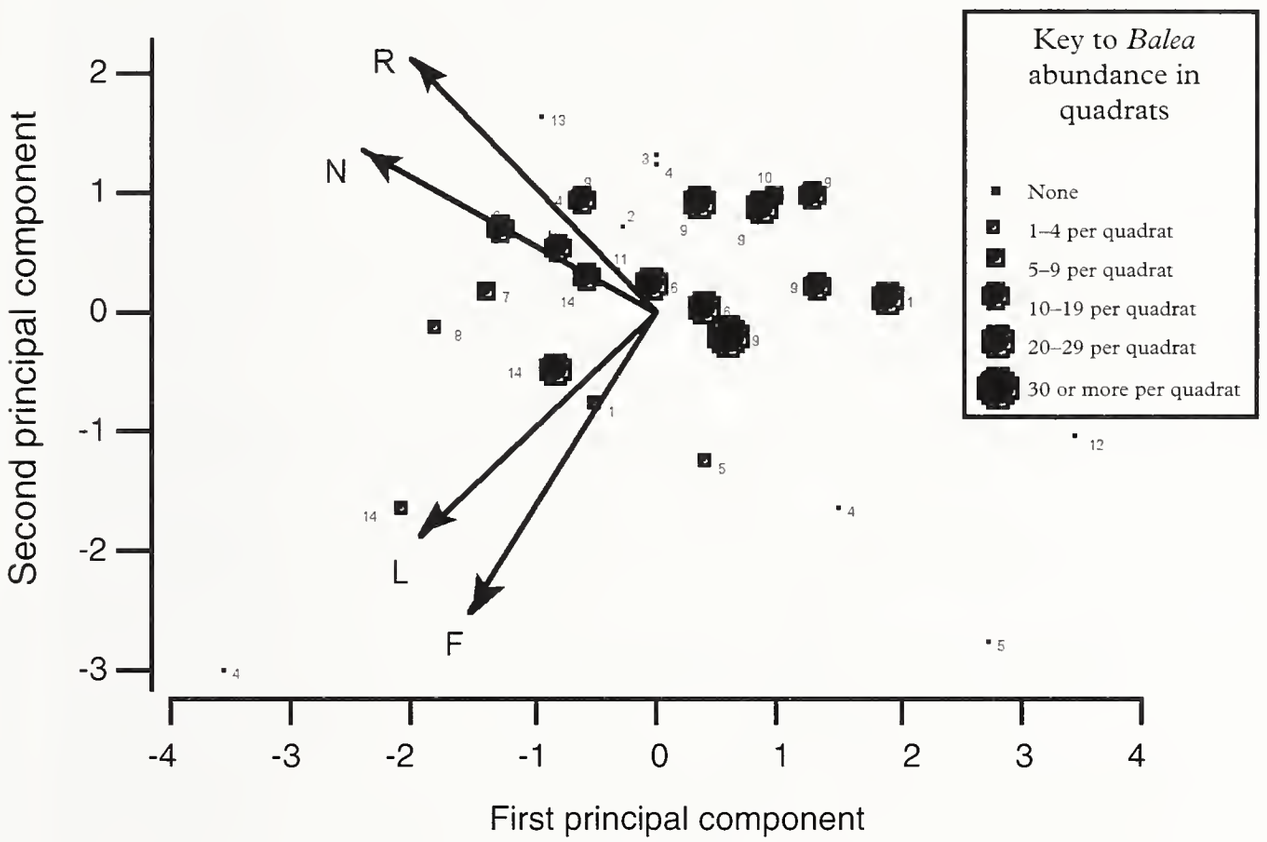

FIGURE 6. Relationship between *Balea biplicata* abundance (measured in 19 quadrats) and soil pH (R), nutrient status (N), moisture (F) and amount of light (L) as calculated using Ellenberg values (see text for further explanation). The sites are numbered using the scheme adopted in Table 1, with more than one quadrat being recorded in some sites.

The relationship between number of *B. biplicata* and number of other species was also investigated as a possible reflection of the effects of competition. This relationship is shown on Figure 7, with a line of best fit also being shown. Although the result is not statistically significant (p=0.065) a trend shows higher numbers of *B. biplicata* where numbers of other species are low. A similar result was found when numbers of *B. biplicata* were plotted against the number of individuals of other snail species.

Discussion

Little evidence was found of *Balea biplicata* being particularly selective in terms of habitat occupied as it was found under a range of different tidal influences and in association with varying amounts of woody material, rubble or ivy cover. The greatest abundance was, however, invariably found in secondary

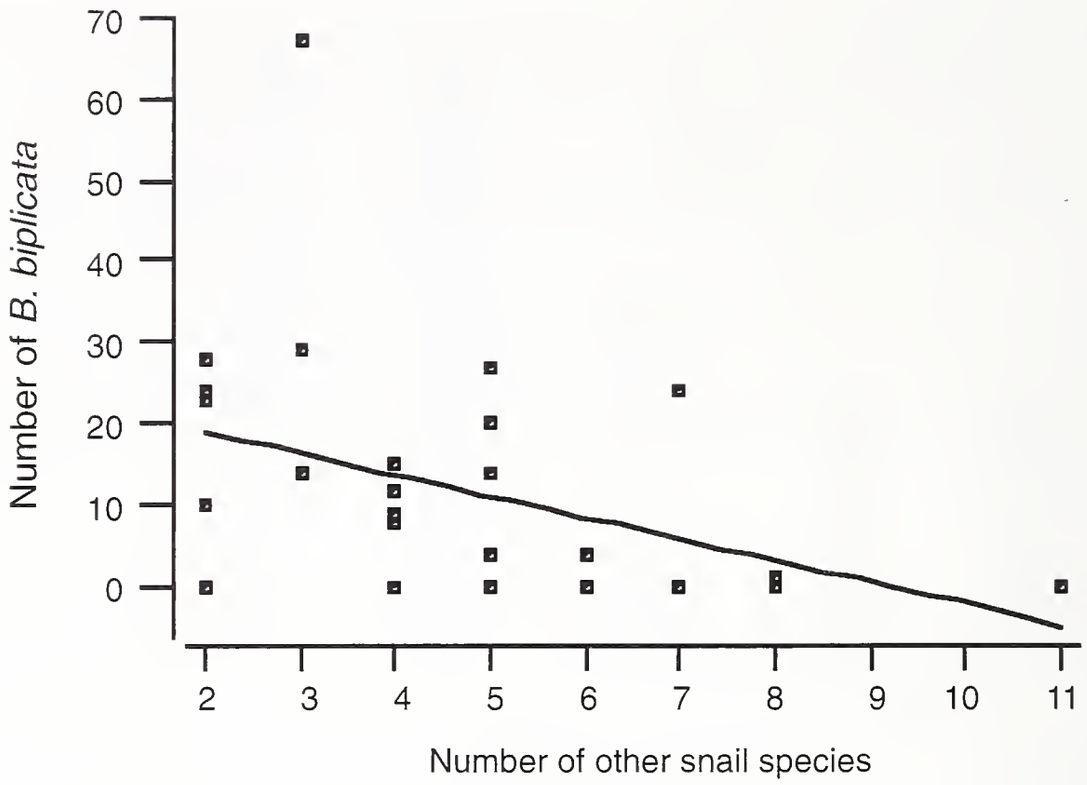

FIGURE 7. Relation between the number of *Balea biplicata* individuals and the number of other snail species per quadrat.

woodland, and, where the snail was present, it tended to be more abundant where ivy cover was greater. It was found on mildly acid to neutral substrates, a finding which is at odds with Boycott's (1929) observation that the species tends to occur in calcareous locations. The snail's apparent preference for woodland is of interest, because Boycott (1929) was unaware 'of any particularised record for "woods" which are frequently mentioned in the older books'. *B. biplicata* is predominantly ground-living and, in one site that is regularly inundated (Site 5, Ferry Quays), it seems likely that it is able to tolerate short periods of inundation, or avoids its effects by climbing beyond the high water level on willow logs or vegetation; a similar observation was noted by Boycott (1929) for a Cambridge site. Many of the locations from which *B. biplicata* was lacking were similar in terms of the variables measured, suggesting that there are suitable unoccupied sites. Where *B. biplicata* was found, however, there was evidence that it occurred more abundantly where ivy cover was greater.

A negative relationship was identified between *B. biplicata* numbers and the number of other species, although this was not statistically significant. The potential effects of competition between it and other mollusc species remains unclear although Welter-Schultes (1998) has argued that, in Cretan species of the genus *Albinaria* (a genus in the same family as *B. biplicata* — Clausiliidae), the presence of competitors reduces the rate of dispersal, perhaps by up to around 75 per cent.

Evidence in the study area suggests that there are potentially suitable but unoccupied sites and that dispersal limitation may therefore constrain the distribution and abundance of *B. biplicata*, at least locally. This view is consistent with Kerney's (1999) statement that *B. biplicata* 'has several times been successfully introduced into gardens' — dispersal limitation being overcome by deliberate human intervention. *B. biplicata* may exhibit metapopulation dynamics with a pattern of local extinctions and recolonizations. Hille et al. (2003) found that eight populations of *B. biplicata* along the Elster/Saale river system (Germany), separated by around 100 km, showed little evidence of systematic differentiation in genetics or morphology.

Abiotic factors or catastrophic events such as flooding and drought appeared to facilitate or cause long-range dispersal and local extinction. In this study, it appears likely that 'unassisted' dispersion has occurred between Sites 7, 8, 9 and 10, with the tide possibly accounting for *B. biplicata* presence at Sites 1, 5, 6 and 14.

What of the distribution of *Balea biplicata* in the context of the British Isles? It occupies habitats that still occur across much of Britain and old records show that it was widely, if sparsely, scattered across southern and eastern England. It must therefore have dispersed to these locations at some time, even if it occurs there no longer and even if these fragmented populations were the remnant of a formerly more widespread and continuous one (although there is apparently no evidence to support the latter). Is the apparent British pattern of vacant and occupied sites no more than the pattern of local dynamics writ large?

B. biplicata's ability to colonize new areas may have seen changes in recent years, perhaps owing to changes in the management of river systems or patterns in the movement of materials. Welter-Schultes (1998) presented evidence for a number of snails in the genus *Albinaria* that dispersal had occurred along with stones used for construction purposes. In this Cretan example, the recent construction boom seems to have had little effect on dispersal because, in contrast with the earlier historic period, the materials are not taken directly from the quarries where *Albinaria* is present. This does not, however, seem a particularly satisfactory explanation for changes in the British distribution of *B. biplicata*. Snails might inadvertently be moved from 'source' to 'sink' populations, which become extinct in the absence of a supply of new recruits. But one might expect raw materials (and snails) to have moved mainly from outlying areas into London rather than the reverse direction.

Why has *B. biplicata*'s distribution in Britain declined and why is the snail now restricted to London? This city is situated in one of the few parts of Britain where mean July temperature exceeds 17°C. We suspect that the main factors affecting distribution at a national level may be different from those working at a local level, although the potential influence of temperature is purely conjectural. To test this further it would be desirable to identify a physiological mechanism linking temperature to the performance of the snail. Observations of *B. biplicata* elsewhere at the limits of its European range may help to identify the main limiting factors in determining its range, although not all factors may operate or be equally important in different places.

The possibility remains that *B. biplicata* may be refound in some of its old haunts, or in new locations. Boycott (1929) noted that populations were 'decidedly circumscribed and the species cannot be found outside of the small area in which it is abundant', an observation also noted in this study.

The findings of this study are of interest, particularly with regard to conservation initiatives for *B. biplicata* in London. The London BAP states that *B. biplicata* has a 'specialized habitat' along the intertidal zone of riverbanks, but we found it to occupy a much wider range of habitats. Development is likely to be the main threat to this species in London but, if dispersal limitation does contribute to its rarity, creating or retaining habitat links may be an important way to minimize impacts whilst artificial introduction may also be an option. Recommendations for current and future conservation initiatives are summarized here:

1. Where development is proposed along the Thames corridor within or close to the existing range of *B. biplicata* and where suitable habitat exists (Table 3), a dedicated survey should be undertaken to establish whether this species is present.

2. Where *B. biplicata* is present, every attempt should be made to retain the habitat and manage it to promote a shaded environment with well-developed field layer, retention of cut logs and other refugia, well-linked habitats and, where river walls are present, retention of walls and enhancement by addition of timber fenders to provide crevices and niches for establishment of vegetation.
3. Where it is not possible to retain *B. biplicata* on site, translocation to a receptor site may provide the best means of preventing any overall loss.

TABLE 3. Habitats known to support *Balea biplicata*.

Secondary woodland, tree lines or hedgerows on dry to damp soils with a well-developed field layer (e.g. ivy).
Ruderal vegetation and scrub with good ground cover.
Riparian or intertidal vegetation.
River walls at or above high tide level, particularly where vegetated or with crevices.
Rubble and/or woody debris, especially where associated with vegetation.
Flotsam at the strand line.

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Spiders of Hampstead Heath: an ongoing story of ecological change

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Abstract and keywords

A brief history of the landscape and ecology of Hampstead Heath (including the Kenwood Estate and Golders Hill Park) is given, followed by an annotated list of spiders recorded there, with their observed habitat preferences. Since the earliest records in 1736, a total of 218 species has been recorded, and one spider parasite. Of these species, three have not been seen on the Heath for nearly three hundred years and are thought to be extinct.

The Heath is divided into nine Sectors for study purposes; 45 species have been recorded from at least eight of these Sectors and this group, the commonest species on the Heath are given **in bold** in the Appendix.

KEYWORDS: Hampstead Heath, Kenwood, historical ecology, spiders, spider ecology, spider habitats, atmospheric pollution, terrestrial eutrophication, grassland management, coppicing.

Introduction, and history of habitats found on the Heath

Hampstead Heath, together with the Kenwood Estate and Golders Hill Park make up a large area (324 hectares, 800 acres) in north London between the old villages of Hampstead and Highgate, the main part of which was first proposed as a public open space in 1853. After a protracted battle with the chief landowner, Sir Thomas Wilson, the first part of the Heath comprising Sandy Heath, West Heath, Vale of Health and East Heath, in total about 220 acres were purchased for the public in 1871 under the Hampstead Heath Act which provided that '(the Metropolitan Board of Works) shall for ever keep the Heath open, unenclosed and unbuilt upon.' Various other parcels including the Kenwood Estate have been added at different times since.

Some of the Heath is among the highest land in north London, rising as it does to 134 metres (440 feet) at the flagstaff by Jack Straw's Castle. The Heath includes the valleys of two southeast-flowing streams (the western Hampstead Brook and the eastern Highgate Brook) and catchment of at least two small streams that flow north through Golders Hill Park and Hampstead Heath Extension.

Spiders have been studied and recorded on Hampstead Heath for nearly 300 years. In 1736 Edward Albin published a list of spiders known from Ken Wood, and some of the more spectacular species were illustrated by his wife Eleanor Albin (Albin 1736). These included *Araneus marmoreus pyramidatus* (now

known as a colour form of *A.marmoreus*), *Micrommata virescens* and *Diaea dorsata*, none of which have been seen at Ken Wood or elsewhere on Hampstead Heath for more than a century. Another species referred to by Albin, *Pisaura mirabilis,* may have become quite scarce by the 1970s (Russell-Smith, 1978, makes no mention of it) but today it is common in long grass in most parts of the Heath. *Atypus affinis*, although not known from Kenwood, was found on the sandy upper slopes above the Vale of Health in the 1870s (Enock, 1885, 1887) and although apparently not seen again for over a hundred years, it was was rediscovered in the same area in 1995 (Milner 1995*a*). In recent years many new species have been found, some of which, such as the tiny *Tapinocyboides pygmaeus,* may have been missed by earlier naturalists, while others such as *Argiope bruennichi* have probably only recently arrived. Still others, such as *Agelena labyrinthica* probably disappeared at the height of the 'mow it all' phase of management and have recently re-appeared.

The changing nature of the Heath is reflected in the story of these and other spider species whose success has varied as a result of the various environmental assaults suffered by the area since the eighteenth century. There is reason to believe that the Heath as a whole is now witnessing a partial ecological recovery as a result of changes to the management of many areas, and this improvement has given rise to significant changes to the spider fauna (Milner 2005). For most of the years since 1991 until 2005, the author has conducted long-term pitfall-trapping (commissioned by Corporation of London, now City of London) at several key sites and the changes in the trapped fauna have been detailed. In addition, on the Ladies' Swimming Pool Meadow several species of orb-web spider now thrive where just a few years ago very few were to be found.

The earliest spider records for the Heath date from the eighteenth century (Albin 1736) and in more recent times collections based on searching, sweep-netting and beating have been made by Savory and Le Gros (1957), Russell-Smith (1978) and the author (Milner: various). Unfortunately, regular pitfall-trapping and spider monitoring work on the Heath has recently been suspended, but it is to be hoped that it may restart in the near future, so that the continuing changes under the improved management can be documented.

The changing habitat of the Heath for spiders

The habitat has certainly changed a good deal since Albin's time, although the relative importance of different factors is difficult to assess. In the eighteenth century while much of what is now West Heath, Sandy Heath and the north-western parts of the main heath (East Heath and the area around the Vale of Health), was rough pasture used for grazing cattle, as can be seen from contemporary descriptions and engravings (Farmer 1984). A good deal of landscaping was done in the area during the eighteenth and nineteenth centuries but much of the eastern part of the Heath, from Kenwood House south to Parliament Hill, including Kite Hill and much of what is now the central woods, was farmland divided by hedgerows until the 1850s. Some hedges remain although they have spread somewhat and in places are now six or more metres wide.

By the middle of the nineteenth century the marshy area of the Vale of Health (upper part of the valley of the Hampstead Brook) was drained and the pond created (Farmer 1984). Housing gradually encroached on the Heath both there and further west around Branch Hill (now separated from West Heath), and the Pryors on East Heath, etc.

Large amounts of sand and gravel were extracted from the upper parts of the Heath for at least 300 years, coming to a climax in the late nineteenth century, and this activity caused the many surface irregularities visible today. In the 1860s contemporary eyewitnesses of the area adjacent to Spaniards Road bemoaned the 'dreary, desert prospect of hideous pits and shapeless heaps

as far as the view extends over the hill itself, with a few miserable furze-bushes here and there, a ragged tuft of dusty ling, or some wretched weed content to grow in its degraded situation, but without one square yard of verdant turf for a baby to roll on.'(*Illustrated London News*, 1871, quoted by Farmer 1984). A contemporary photograph (Farmer 1984: 96–97) confirms that a large area had been turned into a wasteland. Virtually all the natural flora and fauna was removed from large stretches of the area. Further damage to the Heath would inevitably have been caused by trampling of large crowds that visited it on holidays, especially after 1860 when the Hampstead Heath Junction Railway opened providing a direct link to the East End of London. For example, according to contemporary eye-witnesses, Easter Monday in 1884 saw a crowd estimated at the time at 'not far short of 100,000' (*Hampstead & Highgate Express*, quoted by Farmer 1984).

Actual heathland or even rough pasture had virtually disappeared by the 1880s although some areas of gorse *Ulex europaeus* were still to be found (Enock 1885), and a few plants of heathland species such as *Calluna vulgaris*, *Erica cinerea* and *E. tetralix*, *Vaccinium myrtilis*, and *Salix repens* (ssp. *repens*) can still be found or have been found within the last fifty years or so (Kent 1975). Of these, the first three have also been supplemented at various times by restorative planting above Vale of Health, more successfully on Sandy and West Heaths, and also at Kenwood. Gorse has also been planted at different times and in several places. Enock (1885) observed that it occurred extensively on the upper slopes when he was searching for *Atypus*, so it is possible that some patches such as those above Vale of Health have been in place for centuries rather than decades. Of the other gorse patches, the extensive one on Sandy Heath appears to be the oldest. A number of scarce spiders have been found in this patch and the Vale of Health patch, but not yet in any of the more recently planted areas such as those at Hampstead Gate and on South Meadow.

On the slopes between the Vale of Health and Jack Straw's Castle today, there are gorse thickets and some broom *Sarothamnus scoparius*. The area bears perhaps the nearest resemblance today to the unenclosed part of the Heath of three hundred years ago. The presence of rabbits has maintained the grassy areas, preventing the establishment of tree seedlings, although there is a tendency for bramble to increase and, when periodically disease reduces the rabbit population, for oak seedlings to appear and thrive.

Among the losses to the heath habitat over the last two hundred years has been the disappearance of juniper *Juniperus communis* ('long extinct' according to Kent 1975) but still common up to the end of the nineteenth century (Enock 1885). Juniper provides a very good habitat for spiders and so its absence today is almost certainly a contributory factor to an impoverishment of the specifically heathland spider fauna. It is not found anywhere on the Heath today, except for a few recently planted specimens among the gorse on Sandy Heath.

When London County Council took over running the public open space, which had been extended under the Hampstead Heath Enlargement Act (1886), they began with that familiar idea of 'tidying up' the area — a misguided approach that continues to influence the management of many public open spaces even today. The LCC filled in damp areas, planted trees (including some of the exotic species still found today) and burned both heather and gorse. This caused a public outcry until members of the newly formed Hampstead Heath Protection Society (now the Heath and Hampstead Society) dissuaded them and the whole approach was put on hold (Waite et al. 1993). Unfortunately the Heath has seen a return of this approach on more than one occasion since then.

Over much of the Heath, both the old fields and the upper parts where gravel was extracted, the natural grassy vegetation has been replaced by

secondary woodland, which, in the absence of grazing animals, continues to encroach in some places. It is possible that some of the oldest oaks on the Heath were originally emergents in old hedges. The presence of wild service and aspen support the idea that parts of the habitat are very old, as does the recent find of the rare spider *Haplodrassus silvestris,* which is associated with ancient woodland. Part of Kenwood is certainly ancient woodland and is designated as an SSSI on the basis of its dead-wood fauna.

Exotic species such as Turkey oak *Quercus cerris* and false acacia *Robinia pseudoacacia* have been planted at different times since the nineteenth century, and occasional examples can be found within much of today's woodland. In Kenwood the sessile oak *Quercus petraea* predominates while elsewhere pedunculate oak *Q. robur* occurs with it; the other common trees are birch (mainly *Betula pendula*, but also *B. pubescens* and hybrids: Kent 1975), hawthorn *Crataegus* spp. and holly *Ilex aquifolium*, while hornbeam *Carpinus betulus* and hazel *Corylus avellana* are less common. Much of the woodland has been invaded by sycamore *Acer pseudoplatanus*. In several places there are elm *Ulmus* spp. thickets, but large elms are extremely scarce; the largest known to the author is a single tree of at least 25 m still standing below the Vale of Health slopes. The woodland on West Heath shows little evidence of having been coppiced in the past, although some oaks on West Heath and at least one rowan stool may be examples of long-neglected coppice. In the twentieth century coppicing throughout the London area declined and was abandoned completely by the beginning of the Second World War. On the Heath it has been restarted by the City of London in the last few years on a limited scale (above the Lime Walk, and above the enclosed Bird Sanctuary).

In some places the grassland has been 'improved' and resown with hard-wearing species such as *Lolium perenne*, and most of the grassland except on the steeper slopes was for many years (1980s and up to the late 1990s) subjected to frequent compaction, trampling and disturbance due to machine-mowing when 'tidiness' (i.e. homogenization) was a popular guiding principle for the management of public open spaces. As there was no incentive for visitors (or their dogs) to keep to paths, and uncut areas were few and far between; the result was widespread trampling and environmental damage over more or less the entire Heath, apart from enclosed areas.

This has changed in the last two decades, and managers have taken more account of the conservation of grassland and its invertebrate fauna. 'In order to support the greatest possible range of invertebrates, a grassland must have a good range of successional stages and vegetation structures, from bare ground to scrub and from short open turf to tall grass and tussocks' (Kirby 1992). Policy 11 of the current Management Plan (Corporation of London 2001) states that the Corporation (now City of London) 'recognises the importance of maintaining wildlife biodiversity . . . in the management of the Heath'. More-sensitive management has progressed well, to the extent that a number of the 'lawns' of the 1970s and 1980s have reverted to meadows, on which only limited desire lines are now mown. As a result, in spite of the increasing numbers of visitors and especially dogs, there has been a gradual recovery of a more-natural sward with features such as tussocks, anthills and other surface irregularities, although in some places this has been accompanied by invasions of thistles and vigorous grasses such as *Holcus* spp. Apart from mowing policy, successive regimes managing both the Heath and Kenwood have influenced the conservation of the various habitats in different ways. Some areas (Bird Sanctuaries), mainly woodland and marsh, have been fenced off for many years and the reduced levels of disturbance have benefited many other plants and animals besides birds.

The effects of pollution

Acid air pollution must have adversely affected all habitats during much of the nineteenth and twentieth centuries until the Clean Air Acts of the 1950s after which the deposition of sulphurous soot in particular virtually stopped. Nonetheless, acid rain has continued to be an intermittent problem. According to English Nature, 'there have been (in recent years) substantial reductions in the emissions of sulphur dioxide (80%) and oxides of nitrogen (40%) from their peak.' Thus although sulphur dioxide pollution has declined dramatically, nitrogen deposition remains a major threat to semi-natural ecosystems, most of which are characterized by low levels of nutrients. 'The (continuing) major sources of nitrogen oxides are emissions from industry (40%) and traffic (45%)' (Townshend et al. 2004). While sulphur and particulates do not rain down from the atmosphere today, the environment is still influenced on a continuous basis by this atmospheric pollution.

Dogs, and to a lesser extent humans, have also contributed to increased nutrient levels in both terrestrial and aquatic habitats. Shaw et al. (1995) studied the ecological effects of dog waste on heathland near London and concluded that 'soil eutrophication caused by canine wastes was a factor affecting heathland flora.' At Hampstead Heath, dog-waste bins were first installed near rugby pitches on the Extension in 1996, and elsewhere subsequently, but as there is no enforcement this problem has by no means been eradicated.

The effects of earlier pollution and its reduction in the 1980s and 1990s, as well as those caused by ongoing eutrophication, have been most intensively studied in relation to bryophytes, a plant group known to be particularly sensitive to the effects of atmospheric pollution. 'There was a virtually linear (year by year) post-1960 fall in atmospheric SO_2 concentration in the air of north London, of some 63 $\mu g/m^3$ per decade, and . . . (as a result) not only have a number of (bryophyte) species returned . . . but several species never recorded in the region before . . . have appeared and spread rapidly.' (Adams 2004). Specifically on Hampstead Heath, Adams notes the reappearance after many years of seven SO_2-sensitive bryophytes, some of them nutrient-seeking species, since the early 1980s (Adams and Preston 1992, quoted by Read 1996). Contemporary field research both in UK and The Netherlands indicates that 'nitrogen is thought to be (now) slowing or preventing the recovery of lichens that followed the reduction in sulphur dioxide concentrations . . . and diverse lichen communities are being ousted by a few species tolerant of high nitrogen levels. Nitrogen deposition (can also) change the interactions between plants in favour of widespread competitive species . . .'(Townshend et al. 2004).

For effects on the spider fauna, there is little historical evidence (there appear to have been no specific studies made of the effects of atmospheric SO_2 on spiders) but some suggestions can be made. Invertebrates, especially spiders are largely affected by changes in the structure and composition of the flora, especially by the encouragement of competitive species such as *Dactylus glomeratus*, *Holcus* spp., *Urtica dioica, Rubus* spp. etc., at the expense of species such as *Festuca* spp. and *Agrostis* spp., even on the nutrient-poor soils of the upper Heath. This is part of the trend towards uniformity of habitat, especially grassland, irrespective of history or soil. The effect on spiders would very likely be to disadvantage diverse grassland specialists and encourage ubiquitous species and pioneers.

The effects of management on the spider fauna

From the above it can be seen that there have been numerous interacting influences, which have affected the Heath as a continually changing habitat for spiders. The overwhelming majority of species recorded from the Heath today are robust species that can survive well in disturbed habitats, whether these are grassland, woodland, scrub or wetland.

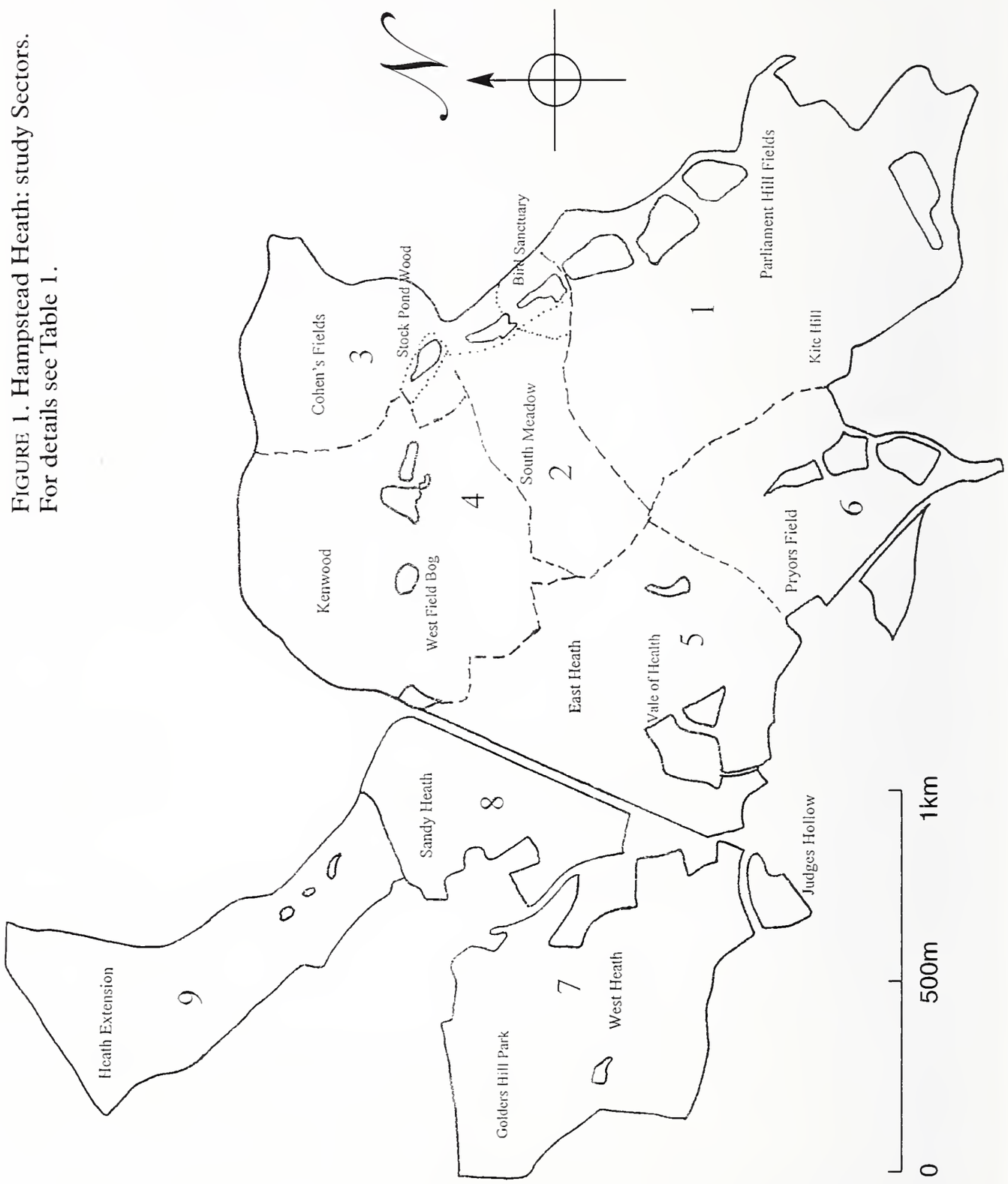

FIGURE 1. Hampstead Heath: study Sectors. For details see Table 1.

Sectors for study

For study purposes the Heath has been divided into nine Sectors shown in Figure 1. Details of the Sectors are given in Table 1.

TABLE 1. Study Sectors of the Heath.

Sector	Main areas	Main habitats
S1	Parliament Hill Fields and adjacent meadows	Mainly species-poor grassland and old hedgerows
S2	South Meadow, Ladies' Swimming Pool and adjacent wet areas	Unimproved grassland, secondary woodland and some old hedgerows, marshy areas, small lakes and stream
S3	Cohen's Fields, Stock Pond and adjacent meadow	Unimproved grassland, an ex-'flower meadow', some marsh, secondary woodland, lake and stream
S4	Kenwood Estate	Woodland, mostly ancient but some secondary, unimproved meadows, a *Sphagnum* fen and small lakes
S5	Woods and Meadows around Vale of Health	Mainly secondary woodland, some fragments of ancient woodland, or at least ancient hedgerows, both acid and neutral grassland, an area of old gorse, and some heather
S6	East Heath, Priests Hill and adjacent wet areas	Improved neutral grassland, unimproved acid grassland, some areas of secondary woodland
S7	West Heath, including Judges Hollow	Woodland (probably all secondary), and improved grassland, some of it on old sand/gravel pits
S8	Sandy Heath	Woodland (probably all secondary) on old sand/gravel pits. Some old gorse; small lakes and marshland; some replanted heather
S9	Hampstead Heath Extension	Grassland, some unimproved but mainly improved, secondary woodland; some marshy areas along the stream, which has been turned into a series of pools.

The loss of three species mentioned by Albin (1736) is attributable to some of these changes. Apart from the common garden spider *Araneus diadematus*, large orb-web spinners are particularly sensitive to web damage and may be unable to catch enough food to maintain and repair webs that are damaged too frequently. *Araneus marmoreus* (whose web can be ten feet across between anchor points) is unlikely to return while the current levels of disturbance of open ground obtain. In recent years both *Araneus quadratus* and *Larinioides cornutus* were absent or very scarce indeed until the management of the Ladies'

Swimming Pool Meadow was changed and mowing restricted; now both are common on the meadow and also in some surrounding areas of similar habitat such as Stock Pond Meadow and the lower part of Tumulus Field. It is surely no coincidence that two other spectacular web-spinners, *Argiope bruennichi* (orb-web) and *Agelena labyrinthica* (sheet-web) have appeared in the same area within the last few years, while the former has spread and since 2003 has been found in a number of other unmown parts of the Heath.

Some small grassland specialist spiders, including the small jumping spider *Talavera aequipes* and the rare *Tapinocyboides pygmaeus,* are found only in the least disturbed and most natural stretches of grassland such as Pryors Field and the rabbit-grazed slopes above the Vale of Health. This latter site is also home to the small surviving colony of the heathland tube-web spider *Atypus affinis.* The sloping ground as well as the sandy or gravelly soil may also be less susceptible to the effects of nitrogen deposits as run-off and leaching may wash it away.

Spiders on the Heath

In total, 218 species of spider have so far been recorded on the Heath as a whole, of which three have not been seen since 1736 and are assumed to be extinct, although of these, two are still known from other sites in the London area. These are *M. virescens* and *D. dorsata* (contemporary records from Oxleas Wood and Ruislip Common respectively). The third of Albin's species, *Araneus marmoreus*, is not known today from the London area.

A list of species recorded is given in the Appendix, which includes details of when each was first recorded, and their current actual recorded occurrence in different sectors. All records are by the author except where indicated; in the case of some common species (such as *Trochosa terricola*) this appears to be the first published record. However the implication that these species have been absent up to now, is unsustainable and the lack of records may be explained by the fact that previous authors restricted their collecting to a few summer months. *T. terricola*, for example, is easy to find in early spring but more elusive later in the year.

Altogether thirty-seven species have been recorded from all nine sectors, but a further eight species have been found in all Sectors except 8 (Sandy Heath) where pitfall trapping has only been done in scrub and woodland and not in grassland. These forty-five species should be taken as the commonest species on the Heath. The group includes five lycosids, two species of *Pachygnatha* and thirty-two linyphiids.

Three species (*Oonops pulcher, Bathyphantes nigrinus* and *Taranucnus setosus*), have been recorded once each without the Sector being recorded. Excluding extinct species and those recorded from unspecified Sectors, forty-one species have been recorded from only a single Sector.

An annotated species list for the Heath (including Kenwood) follows. In this list species given **in bold** are those recorded from all nine Sectors, and (S) numbers refer to the Sector number.

In the list and table below, nomenclature and the order of families of spiders are according to Merrett and Murphy (2000) with amendments in Harvey et al. (2002).

Annotated list of species

SPIDERS

Atypidae

Atypus affinis Eichwald, 1830

The Tube-web Spider was first described from the Heath by Enock (1885, 1892), although the species was referred to by various authors subsequently (e.g. Ellison 1913; Bristowe 1939–41; Savory and Le Gros 1957; Russell-Smith 1978). When Russell-Smith's paper was published, a

comment was added by W.S. Bristowe: 'Having read A. Russell-Smith's note "Spiders of Hampstead Heath" . . . . I am tempted to ask if *Atypus affinis* is still to be found there?' It is likely that various workers, including my predecessor A. E. Le Gros, had subsequently searched for it, all without success.

Eventually it was rediscovered by the author in 1994 (Milner 1995*a*), but it is assumed that the colony survived during the intervening period. The present colony occupies a fairly limited area of perhaps one hectare, on the south-facing slopes above Vale of Health (S5), and is easily overlooked.

Pholcidae

Psilochorus simoni (Berland, 1911)
Only recorded by R. A. Softly (pers. comm.) who found a specimen in his moth-trap operated from an open area of East Heath (Sector 5).

Dysderidae

Dysdera crocata C.L.Koch, 1838
Only recorded from Kite Hill and Ladies' Swimming Pool meadow.

Harpactea hombergi (Scopoli, 1763)
Common under bark of older trees throughout the Heath.

Oonopidae

Oonops pulcher Templeton, 1835
Only recorded by Russell-Smith (1978).

Oonops domesticus de Dalmas, 1916
Only recorded by Savory and Le Gros (1957). Recent findings (2005–6) have all been juveniles and not identifiable to the species.

Mimetidae

Ero cambridgei Kulczynski, 1911
Only three records; from the heather patch and from long grass both on the Vale of Health slopes (S5), and also from the planted gorse bushes at the north-east corner of South Meadow (S2).

***Ero furcata* (Villiers, 1789)**
Occasionally found in all parts of the Heath.

Nesticidae

Nesticus cellulanus (Clerck, 1757)
A single record from a small area of mossy woodland south-west of the Vale of Health (S5).

Theridiidae

Steatoda bipunctata (Linnaeus, 1758)
Recorded by F.P. Smith (1901) at Golders Hill Park (S7), and probably occurs under bark and on buildings across the Heath, but the only recent record is from the bark of a sycamore on Sandy Heath (S8) in February 2006.

Anelosimus vittatus C.L.Koch (1836)
Uncommon; has occasionally been swept from bushes in several parts of the Heath.

Theridion sisyphium (Clerck, 1757)
Occurs frequently in gorse and bramble on the higher parts of the Heath.

Theridion varians Hahn, 1833
Occasionally swept from trees and bushes in several parts of the Heath.

Theridion familiare O.P.-Cambridge, 1871
A single female swept from long grass on West Heath meadow (S7) in May 1994.

Theridion melanurum Hahn, 1831
Recorded by Russell-Smith (pers. comm.).

Theridion mystaceum L.Koch, 1870
Swept from lower branches of small pine inside the Bird Sanctuary (S2) in May 2003.

Theridion tinctum (Walckenaer, 1802)
Occasionally swept from bushes and the lower branches of trees.

Neottiura bimaculatum (Linnaeus, 1767)
Frequently found in long grass and tall herbs.

Paidiscura pallens (Blackwall, 1834)
Reported by Russell-Smith in 1972 (pers.comm.) and in 1994 by Dan Hackett (pers.comm.).

Enoplognatha ovata s. s. (Clerck, 1757)
Frequently found in most parts of the Heath.

Enoplognatha latimana Hippa & Oksala, 1982
Trapped in Ladies' S P Meadow (S2) in 1996 and swept from tall herbs in the nettlebed area east of East Heath (S6) in 1997 and 2002.

Enoplognatha thoracica (Hahn, 1833)
First recorded by Russell-Smith (1978); frequently found in grassland in most parts of the Heath including Kenwood.

***Robertus lividus* (Blackwall, 1836)**
Common in small numbers in most parts of the Heath.

Robertus arundineti (O.P.-Cambridge, 1871)
First recorded in 2005, on Vale of Health slopes (S5) and at West Field Bog, Kenwood (S4).

Pholcomma gibbum (Westring, 1851)
Mainly recorded from gorse litter above Vale of Health (S5) (not from any of the more recently planted gorse patches), but also from woodland litter in several heavily shaded situations.

Linyphiidae

Ceratinella brevipes (Westring, 1851)
Recorded by Russell-Smith (1978) as a new record for London. Occasional individuals have been trapped in least-disturbed grassland in Sectors 1 and 5.

***Walckenaeria acuminata* Blackwall, 1833**
Found at all seasons in both woodland and grassland in all parts of the Heath.

***Walckenaeria antica* (Wider, 1834)**
Commonly found in all grassland parts of the Heath.

Walckenaeria cucullata (C.L.Koch, 1836)
Occasionally trapped in all four major habitats (grassland, woodland, scrub and marshland) in most parts of the Heath.

Walckenaeria atrotibialis (O.P.-Cambridge, 1878)
First recorded by Russell-Smith (1978); commonly found in most grassland, under gorse, in damp areas and in the newly coppiced areas of woodland (S5). Also recorded in small numbers at Westfield Bog, Kenwood (S4).

Walckenaeria nudipalpis (Westring, 1851)
First recorded by Russell-Smith (1978); found in most damp areas on the Heath including Westfield Bog (S4).

Walckenaeria unicornis O.P.-Cambridge, 1861
Three records; from ancient gorse at Vale of Health (S5), in the *Phragmites* reedbed in the Bird Sanctuary (S2), and in an area of *Glyceria maxima* on the site of an old pond on Pryors Field (S6).

Walckenaeria cuspidata Blackwall, 1833
A single female found on Westfield Bog (S4) in February 1985.

'Dicymbium nigrum'
Recorded by Bristowe (1929) before the two following species were split.

Dicymbium nigrum (Blackwall, 1834)
(Only males are distinguishable from *D. brevisetosum*.) First recorded by Russell-Smith (1978); a few individuals recorded in November and December 2002 from Tumulus Field (S1) and three individuals recorded March 2003 and May 2004 from the upper coppice area (S5).

***Dicymbium brevisetosum* Locket, 1962**
Found at all seasons in grassland and especially damp areas, all over the Heath.

Entelecara congenera (O.P.-Cambridge, 1879)
Three records; a female swept from ancient gorse above Vale of Health (S5) in September 1994, and a male in May 1995; a female swept from old gorse on Sandy Heath (S8) in July 2002.

Entelecara erythropus (Westring, 1851)
First recorded by Russell-Smith (pers. comm.) (locality unspecified) but not seen since.

Gnathonarium dentatum (Wider, 1834)
First recorded by Russell-Smith (pers. comm.); occurs in small numbers in all marshy areas on the Heath.

Gongylidium rufipes (Linnaeus, 1758)
First recorded by Russell-Smith (pers. comm.); since recorded quite frequently in most scrub, marsh and woodland areas.

Dismodicus bifrons (Blackwall, 1841)
First recorded by Russell-Smith (1978); occasionally found in most damper and long grass areas, and some scrub.

Hypomma bituberculatum (Wider, 1834)
Frequently found in most damp grassy areas such as the Bird Sanctuary (S2), and also in tall herbs at the nettlebed on East Heath (S5).

***Maso sundevalli* (Westring, 1851)**
Found in all habitats and in most parts of the Heath, but most often in small numbers in woodland, old hedges and scrub.

Pocadicnemis pumila (Blackwall, 1841)
First recorded by Russell-Smith (1978) in marshy areas, and subsequently three females on Vale of Health slopes (S5) in June 1995, and one female in an area of *Glyceria maxima* on Hampstead Heath Extension (S9) in August 1997.

***Pocadicnemis juncea* Locket & Millidge, 1953**
Small numbers are frequently found in most damp or scrubland habitats and sometimes in grassland in most parts of the Heath.

Oedothorax gibbosus (Blackwall, 1841)
First recorded by Russell-Smith (pers. comm.); occasionally found in most damp or marshy areas.

Oedothorax fuscus (Blackwall, 1834)
Common and often abundant on the more-disturbed grassland and occurring in varying numbers on some more natural grassland areas such as Tumulus Field. Virtually absent from the most natural grassland areas; only once recorded from Pryors Field, and not at all from Vale of Health slopes.

Oedothorax agrestis (Blackwall, 1853)
Trapped on several occasions in 1995 and 1996 in the small Stock Pond Marsh (S3), and two individuals from a marshy area on West Heath (S7).

Oedothorax retusus (Westring, 1851)
Common and often abundant in most disturbed grassland, but tends to be more frequent in damper areas than *O.fuscus*. Not recorded from natural grassland areas except one individual from Pryors Field (S6).

Pelecopsis parallela (Wider, 1834)
First recorded by Russell-Smith (1978); Occasionally trapped on more 'natural' short grassland sites; slopes above Vale of Health (S5), Judges Hollow (West Heath: S7), Tumulus Field (S1) and Dairy Meadow, Kenwood (S4).

Cnephalocotes obscurus (Blackwall, 1834)
First recorded by Russell-Smith (1978); common in most grassland areas.

Ceratinopsis stativa (Simon, 1881)
Occasionally found on all the more natural and less-disturbed grasslands.

***Tiso vagans* (Blackwall, 1834)**
First recorded by Russell-Smith (1978); found in all drier grassland areas on the Heath.

Troxochrus scabriculus (Westring, 1851)
A single individual was trapped in June 1991 on Pryors Field (S6).

Tapinocyba praecox (O.P.-Cambridge, 1873)
A winter-active species found in the more natural grassland in all parts of the Heath.

Tapinocyba insecta (L. Koch, 1869)
Found by F.R. Wanless (pers. comm.) in 1971, and two specimens trapped in woodland litter in Kenwood in October 1990.

Tapinocyboides pygmaeus (Menge, 1869) **RDB3**
This rare dry grassland specialist has been trapped, sometimes in numbers of ten or more, on Pryors Field (S6), Tumulus Field (S2), Nettlebed (S6), Westfield Bog and West Meadow (Kenwood; S4), and since 2003 on Kite Hill (S1).

***Monocephalus fuscipes* (Blackwall, 1836)**
A woodland species, first recorded by Russell-Smith (1978) and found in all woodlands and some adjacent grasslands.

Lophomma punctatum (Blackwall, 1841)
A marshland species first recorded by Russell-Smith (1978); present in most marshy areas on the Heath.

***Gongylidiellum vivum* (O.P.-Cambridge, 1875)**
First recorded by Russell-Smith (1978); usually solitary, found in all grasslands and in some marshy areas, and very infrequently in woodlands.

***Micrargus herbigradus* (Blackwall, 1854)**
First recorded by Russell-Smith (1978); usually solitary, found in all habitats but perhaps most often in woodlands.

Micrargus subaequalis (Westring, 1851)
A disturbed-grassland species, less common than *M. herbigradus*, and not found on the most natural grassland areas such as Pryors Field (S6), and Vale of Health slopes (S5).

Erigonella hiemalis (Blackwall, 1841)
Relatively uncommon; usually but not exclusively found in grassland, in most parts of the Heath.

Savignia frontata Blackwall, 1873
First recorded by Russell-Smith (pers. comm.); has occasionally been trapped in grassland on the east side of the Heath (Sectors 1 to 3 only)

Diplocephalus cristatus (Blackwall, 1833)
Two individuals found in leaf litter in the Battery Woods in February 1985.

Diplocephalus permixtus (O.P.-Cambridge, 1871)
First recorded by Russell-Smith (1978); common, often in considerable numbers in all marshy areas on the Heath, including Westfield Bog (S4).

Diplocephalus latifrons (O.P.-Cambridge, 1863)
Common in all woodland and occasionally found in marshy areas on the Heath.

***Diplocephalus picinus* (Blackwall, 1841)**
First recorded by Russell-Smith (1978); Found in all woodland areas on the Heath, often in large numbers.

Araeoncus humilis (Blackwall, 1841)
A single individual trapped on the east side of Kite Hill (S1) in March 2003.

Panamomops sulcifrons (Wider, 1834)
Frequently trapped on Tumulus Field (S1) and Pryors Field (S6) and in a few other grassy areas.

Milleriana inerrans (O.P.-Cambridge, 1885)
Frequently found on Tumulus Field (S1) and very occasionally has been trapped in a number of other grassy areas.

***Erigone dentipalpis* (Wider, 1834)**
First recorded by Bristowe (1929); found in all grassland areas often in very large numbers, but these diminish almost to zero as grassland recovers from excess mowing or trampling.

Erigone atra Blackwall, 1833
Similar to *E. dentipalpis* but somewhat less common, and tending to occur mostly in smaller numbers.

Leptorhoptrum robustum (Westring, 1851)
First recorded by Russell-Smith (1978); commonly found in marshy areas and less frequently in more natural grasslands.

Jacksonella falconeri (Jackson, 1908)
A single male trapped at Judges Hollow (West Heath) (S7) in January 2005, when it was a new record for London.

Porrhomma pygmaeum (Blackwall, 1834)
One male and five females found in a damp area of on Hampstead Heath Extension (S9) in April 1985.

Porrhomma campbelli F.O.P.-Cambridge, 1894
Occasionally found in damp grassland in various parts of the Heath.

Porrhomma microphthalmum (O.P.-Cambridge, 1871)
Occasionally found in grassland in various parts of the Heath.

Agyneta conigera (O.P.-Cambridge, 1863)
A single female from ancient gorse above Vale of Health (S5) in July 1995.

***Agyneta decora* (O.P.-Cambridge, 1871)**
Found in most grassland areas, sometimes in large numbers.

Meioneta rurestris (C.L.Koch, 1836)
Small numbers found infrequently in grassland in most parts of the Heath.

Meioneta mollis (O.P.-Cambridge, 1871)
A single male trapped in the Nettlebed (S6) in October 1996.

***Meioneta saxatilis* (Blackwall, 1844)**
First recorded by Russell-Smith (1978); occasionally found in both grassland and damper areas all over the Heath.

Meioneta beata (O.P.-Cambridge, 1906)
Occasionally found in grassland in all parts of the Heath, usually in small numbers.

***Microneta viaria* (Blackwall, 1841)**
First recorded by Savory and Le Gros (1957); common in all woodland areas on the Heath, and sometimes found in adjacent grassland.

***Centromerus sylvaticus* (Blackwall, 1841)**
A winter-active species, first recorded by Russell-Smith (1978); widespread in grassland and scrub.

Centromerus dilutus (O.P.-Cambridge, 1875)
A winter-active species found occasionally in most habitats, including Westfield Bog, Kenwood (S4).

Tallusia experta (O.P.-Cambridge, 1875)
First recorded by Russell-Smith (1978); uncommon, found occasionally in some damp areas including the lower part of Judges Hollow (S7), central area of Ladies' Swimming Pool Meadow (S2) and Stock Pond Marsh (S3).

***Centromerita bicolor* (Blackwall, 1833)**
A winter-active species found in all grassland areas in the winter months often in very large numbers.

Centromerita concinna (Thorell, 1875)
A winter-active species; of similar occurrence to *C. bicolor* but much less common.

Saaristoa abnormis (Blackwall, 1841)
First recorded by Russell-Smith (1978); infrequently found in most woodland and scrubland habitats.

***Macrargus rufus* (Wider, 1834)**
A winter-active species; common and sometimes abundant in all woodland and scrubland areas on the Heath.

Bathyphantes approximatus (O.P.-Cambridge, 1871)
First recorded by Russell-Smith (1978); occurs in small numbers in most marshy areas on the Heath except Westfield Bog.

***Bathyphantes gracilis* (Blackwall, 1841)**
Common and often abundant in all seasons and in all grassland, marshland and scrubland areas, also found less often in woodland.

***Bathyphantes parvulus* (Westring, 1851)**
First recorded by Russell-Smith (1978); found in most grassland and marshy areas, but much less common than *B. gracilis*.

Bathyphantes nigrinus (Westring, 1851)
Two records both from August 1984 (no specified site).

Kaestneria pullata (O.P.-Cambridge, 1863)
Recorded by Russell-Smith (1978), but this remains the only record.

***Diplostyla concolor* (Wider, 1834)**
Common and often abundant in disturbed sites, especially in woodland but also occasionally in all other habitats.

Tapinopa longidens (Wider, 1834)
A winter-active species found infrequently in most parts of the Heath in scrub and in grassland/woodland edges.

Floronia bucculenta (Clerck, 1757)
A single female trapped in the Tumulus enclosure (S1) in April 2002.

Taranucnus setosus (O.P.-Cambridge, 1863)
A single female found in woodland litter (site unspecified) in February 1985.

Labulla thoracica (Wider, 1834)
A woodland species. Recorded by Savory and Le Gros (1957), and also by Russell-Smith (pers. comm.) in the 1970s but not recorded since.

Stemonyphantes lineatus (Linnaeus, 1758)
Mostly, but not exclusively, found in winter months in long grass in most parts of the Heath.

Lepthyphantes nebulosus (Sundevall, 1830)
Recorded by Savory and Le Gros (1957), and also by Russell-Smith (pers. comm.) but not recorded since.

Lepthyphantes minutus (Blackwall, 1833)
Occasionally found in most woodland areas; several specimens taken in a bark trap in Battery Woods (S5), in September 1996.

Lepthyphantes alacris (Blackwall, 1853)
Several specimens trapped in woodland at Kenwood (S4) in October 1990.

Lepthyphantes obscurus (Blackwall, 1841)
Recorded by Russell-Smith (1978); but since then only a single female has been found, in the litter below ancient gorse, above Vale of Health (S6).

***Lepthyphantes tenuis* (Blackwall, 1852)**
First recorded by Bristowe (1929); found in all parts of the Heath, in all seasons, and sometimes in large numbers.

***Lepthyphantes zimmermanni* Bertkau, 1890**
A woodland species, recorded first by Russell-Smith (1978); less common than *L. tenuis*, but found at all seasons in woodland or scrub in all parts of the Heath.

Lepthyphantes cristatus (Menge, 1866)
Recorded by Russell-Smith (1978) (when it was a new record for London) but not seen since.

Lepthyphantes mengei Kulczinski, 1887
Occasionally found in grassland and scrub in most parts of the Heath.

***Lepthyphantes flavipes* (Blackwall, 1854)**
A woodland species, first recorded by Russell-Smith (pers. comm.), and found in all seasons in all woodland areas and most scrub habitats as well.

***Lepthyphantes ericaeus* (Blackwall, 1853)**
First recorded by Russell-Smith (1978); found in all seasons in all grasslands in all parts of the Heath.

***Lepthyphantes pallidus* (O.P.-Cambridge, 1871)**
Mostly a winter-active, solitary woodland species occasionally found elsewhere and in other seasons, in all parts of the Heath.

Lepthyphantes insignis O.P.-Cambridge, 1913
A solitary species found occasionally in all the more 'natural' grasslands on the Heath (Pryors Field (S6), slopes above Vale of Health (S5), Tumulus Field (S1)).

Helophora insignis (Blackwall, 1841)
A winter-active woodland species found quite commonly at Kenwood (S4), and less frequently in the central woods of the Heath (S5), Stock Pond Wood (S3), and Sandy Heath (S8).

Linyphia triangularis (Clerck, 1757)
Common on gorse in all parts of the Heath, and occasionally swept from dense vegetation elsewhere.

Linyphia hortensis Sundevall, 1830
A woodland-edge spider first recorded by Savory and Le Gros, occasionally swept from bushes or the lower branches of trees in most woodland areas.

Neriene montana (Clerck, 1757)
Recorded in the 1970s by Russell-Smith (pers. comm.) but not seen since.

Neriene clathrata (Sundevall, 1830)
Found frequently in all habitats and in most parts of the Heath except Kenwood (S4).

Neriene peltata (Wider, 1834)
First recorded in the 1970s by Russell-Smith (pers. comm.) and occasionally swept from bushes or tall herbs, sometimes in damp areas.

Microlinyphia pusilla (Sundevall, 1830)
Recorded by Savory & Le Gros (1957) but only found very infrequently. It has been swept from gorse in July 2002 at Sandy Heath (S8) and taken in pitfalls in and adjacent to Westfield Bog in July and September 2005.

Tetragnathidae

Tetragnatha extensa (Linnaeus, 1758)
A single record; one female swept from long grass on Tumulus Field in June 2002.

Tetragnatha pinicola L.Koch, 1870
A single record; one female trapped in tussock grass and tall herbs inside the Bird Sanctuary (S2) in May 2002.

Tetragnatha montana Simon, 1874
Uncommon; only six records (four since 2002), all from sweep-netting in long grass in different parts of the Heath.

Tetragnatha obtusa C.L.Koch, 1837
A single male from a *Phragmites* bed inside the Bird Sanctuary (S2) in February 1997.

***Pachygnatha clercki* Sundevall, 1823**
First recorded by Bristowe (1929); common in damper grassland in all parts of the Heath.

***Pachygnatha degeeri* Sundevall, 1830**
First recorded by Bristowe (1929); very common and often abundant in drier grassland in all parts of the Heath; less common in damper areas.

Metellina segmentata (Clerck, 1757)
Widely distributed but occurs in small numbers spinning webs usually near the ground in most edge zones of woodland and on gorse in different parts of the Heath.

Metellina mengei (Blackwall, 1869)
Fairly widely distributed and of similar habit and numbers to *M. segmentata* but fewer records.

Araneidae

Gibbaranea gibbosa (Walckenaer, 1802)
Recorded by Russell-Smith (1978) and swept from bushes on Hampstead Heath Extension (S9) in 1994 (Dan Hackett, pers. comm.).

Araneus diadematus Clerck, 1757
First recorded by Ellison (1913), and now common in several parts of the Heath, mostly on bramble or nettles at the edge of woodland. At Ladies' Swimming Pool Meadow it is common around the edge, but very scarce on vegetation in the meadow (unlike other orb-web spiders).

Araneus quadratus Clerck, 1757
First found (a single female) on Ladies' Swimming Pool Meadow in 1991,where numbers have gradually increased, but not elsewhere, except on Hampstead Heath Extension in 1997. Since 2000 numbers on the Ladies' Swimming Pool Meadow have been more than 100 each year, reaching a total of 158 in 2002, when the population had spread to the lower end of Tumulus Field, and the Stock Pond Meadow. Prefers sorrel, bramble, nettle and thistle, but not in shaded situations.

Araneus marmoreus Clerck, 1757
Recorded from Kenwood by Albin (1736), but not recorded since, although if reintroduced could probably survive especially in gorse thickets.

Larinioides cornutus (Clerck, 1757)
First recorded on Ladies' Swimming Pool Meadow in 2001, where it is found commonly since, but not elsewhere, except a single record from Highgate Pond Meadow in 2002.

Nuctenea umbratica (Clerck, 1757)
Occasional records mostly from dead trees.

Agalenatea redii (Scopoli, 1763)
First seen on Ladies' Swimming Pool Meadow (S2) in September 2001, and found there in subsequent years but scarce. A single female was swept from long grass on Pryors Field (S6) in June 2003.

Neoscona adianta (Walckenaer, 1802)
Recorded from the central part of Ladies' Swimming Pool Meadow (S2) in September 2001 and 2002.

Araniella cucurbitina (Clerck, 1757)
First recorded by Bristowe (1929), then by Russell-Smith (pers. comm.), and more recently has occasionally been swept from bushes in several parts of the Heath.

Araniella opisthographa (Kulczynski, 1905)
A single record; trapped in a tussocky glade west of Vale of Health (S5) in July 1996.

Zilla diodia (Walckenaer, 1802)
A single specimen swept from long grass at the north end of the Extension (S9) in July 2002.

Hypsosinga pygmaea (Sundevall, 1831)
Occasionally found in long grass in most parts of the Heath.

Zygiella x-notata (Clerck, 1757)
Only two records, one from a bark trap on a veteran oak tree in the Battery Woods, and one from woodland in Hampstead Heath Extension, but possibly more widespread on buildings etc.

Zygiella atrica (C.L.Koch, 1845)
Recorded by Savory and Le Gros (1957), and both sexes found on gorse on South Meadow in October 1994.

Mangora acalypha (Walckenaer, 1802)
A single adult female was found in a web on mature (replanted) heather *Calluna vulgaris* on Sandy Heath (S8) in May 2006, a new record for London.

Cyclosa conica (Pallas, 1772)
A single record; swept from (old) gorse on Sandy Heath (S9) in September 1994.

Argiope bruennichi (Scopoli, 1772)
First recorded on Ladies' Swimming Pool Meadow (S2) in September 2002, and subsequently occasional individuals have been found at various places including Westfield Bog, Kenwood (S4), but so far not on West Heath, Sandy Heath or Hampstead Heath Extension.

Lycosidae

***Pardosa palustris* (Linnaeus, 1758)**
Common in most grassland areas, occurring in large numbers especially where the grass is short such as where it is mown annually, and sometimes in small numbers within scrub.

***Pardosa pullata* (Clerck, 1757)**
Common and often abundant in all grassland areas, long or short grass, and in small numbers within scrub.

Pardosa prativaga (L.Koch, 1870)
Common in long grass and among tall herbs, but usually in smaller numbers than other lycosids.

***Pardosa amentata* (Clerck, 1757)**
Common and often abundant in damp grass and marshy areas in all parts of the Heath.

Pardosa nigriceps (Thorell, 1856)
Three records only; single individuals from the east side of Kite Hill (S1), long grass on a grassy bank near the nettlebed (S6), and on West Meadow, Kenwood (S4).

Pardosa saltans Töpfer-Hofmann, 2000
Frequent in most woodland areas, and one specimen found under gorse bushes on South Meadow (S2).

***Alopecosa pulverulenta* (Clerck, 1757)**
Common and often abundant in less-disturbed grassland areas in all parts of the Heath. Where sites have recovered from regular mowing, numbers of this species gradually increase over succeeding years.

Alopecosa cuneata (Clerck, 1757)
Common on Pryors Field (S6), and occasional individuals have been recorded from Upper Cohen's Field (S3), the slope below Viaduct Pond (S5), and in an overgrown hedgerow north of Kite Hill (S1), but not elsewhere.

Trochosa ruricola (Deeger, 1778)
Frequently found in most parts of the Heath but usually solitary.

***Trochosa terricola* Thorell, 1856**
Frequently found in all parts of the Heath, sometimes in considerable numbers.

Pirata piraticus (Clerck, 1757)
Found in all marshy areas, often in large numbers, and occasionally in nearby grassland.

Pirata hygrophilus Thorell, 1872
Only recorded from two sites; common in Stock Pond Marsh (S3), and abundant at Westfield Bog, Kenwood (S4).

Pirata uliginosus Thorell, 1856
Abundant at Westfield Bog, Kenwood (S4) otherwise very uncommon; a few individuals at widely separated sites including Hampstead Heath Extension (S9).

Pirata latitans (Blackwall, 1841)
Common and often abundant at Westfield Bog, Kenwood (S4); otherwise only single specimens at three other damp or long-grass sites.

Pisauridae

Pisaura mirabilis (Clerck, 1757)
First recorded from Kenwood by Albin (1736), and recorded by Savory and Le Gros (1957) but apparently absent in the 1970s when Bristowe (comment after Russell-Smith (1972)) wondered if it had now 'vanished from the London scene', but subsequently found by Russell-Smith (pers. comm.) in the late 1970s. Common now in long grass and under gorse in most parts of the Heath.

Agelenidae

Agelena labyrinthica (Clerck, 1757)
Recorded by Savory and Le Gros (1957), but in recent times only seen in the central (undisturbed) part of the Ladies' Swimming Pool Meadow since 2002.

Tegenaria gigantea Chamberlin & Ivie, 1935
Frequent in most woodland parts of the Heath.

Tegenaria atrica C.L.Koch, 1843
Recorded by Russell-Smith (pers. comm.), and in 1990 at Kenwood.

Tegenaria silvestris L.Koch, 1872
Common in woodland at Kenwood (S4), and recorded in 2005 from the edge of Westfield Bog, but not found elsewhere on the Heath.

Hahniidae

Antistea elegans (Blackwall, 1841)
First recorded by Russell-Smith (1978); Found in most marshy areas including Westfield Bog (S4), but usually in small numbers.

Hahnia nava (Blackwall, 1841)
Found in grassland (especially short grass) in most parts of the Heath, but only in small numbers.

Dictynidae

Dictyna arundinacea (Linnaeus, 1758)
Occasionally swept from tall herbs.

Dictyna uncinata Thorell, 1856
Frequently swept from tall herbs in most parts of the Heath.

Nigma walckenaeri (Roewer, 1951)
A single female was swept from tall herbs in Sector 1 in September 2002.

Cicurina cicur (Fabricius, 1793)
A winter-active species; a few individuals have been trapped at widely separated points on the Heath.

Lathys humilis (Blackwall, 1855)
Recorded from litter under ancient gorse at Vale of Health, and swept from old gorse at Sandy Heath in July 2002.

Amaurobiidae

Amaurobius fenestralis (Stroem, 1768)
A single female found under bark of a sycamore tree on Sandy Heath (S8) in February 2006, but probably more widespread.

Amaurobius similis (Blackwall, 1861)
Recorded by Russell-Smith (pers. comm.); common under bark in most woodland areas although formal records are few.

Amaurobius ferox (Walckenaer, 1830)
Only recorded from woodland on Kite Hill (S1) and West Heath (S7) (but probably more widespread).

Coelotes atropos (Walckenaer, 1830)
Recorded from Stock Pond Wood (S3) where it is reasonably common, but not found elsewhere on the Heath. There are no other records of this species in north London; in old woodland throughout London it is usually replaced by *C. terrestris*.

Coelotes terrestris (Wider, 1834)
A single record from the woodland edge of Upper Cohen's Field (S3) in 1999.

Anyphaenidae

Anyphaena accentuata (Walckenaer, 1802)
A single record from under bark of a pine tree at Sandy Heath (S8) in February 2006, but probably more widespread.

Liocranidae

Phrurolithus festivus (C.L. Koch, 1835)
Associated with the meadow ant *Lasius flavus*. Fairly common in less-disturbed grassland, but since 1997 only recorded from the slopes above Vale of Health (S5).

Clubionidae

Clubiona corticalis (Walckenaer, 1802)
Common under bark in all woodland areas.

Clubiona reclusa O.P.-Cambridge, 1863
Common, mostly making its cell on tall herbs, but also found at ground level.

Clubiona stagnatilis Kulczynski, 1897
Single females found on East Heath (S6) and in a tussock area of West Heath (S7) in March 1996 and May 1995 respectively.

Clubiona phragmitis C.L. Koch, 1843
Recorded from areas of marsh grass *Glyceria maxima* on Pryors Field (S6) and Hampstead Heath Extension (S9).

***Clubiona terrestris* Westring, 1851**
Recorded by Savory and Le Gros (1957); solitary but frequently found in all woodland areas on the Heath.

Clubiona lutescens Westring, 1851
Recorded by Russell-Smith (1978) as a new record for London, and individuals have since been found in several parts of the Heath including one of the newly coppiced areas near Lime Walk in 2005 (S5).

Clubiona comta C.L. Koch, 1839
Recorded by Savory and Le Gros (1957); found since in most woodland areas.

Clubiona brevipes Blackwall, 1841
Less commonly found than *C. comta*, but among the five records are one from the upper coppice area in the central woods, and from a bark-trap in the Battery woods (S5) in September 1996.

Clubiona diversa O.P.-Cambridge, 1862
Two records; single males from Tumulus Field (S1) in June 2002 and Judges Hollow, West Heath (S7) in June 2005.

Cheiracanthium erraticum (Walckenaer, 1802)
Common since 1995 in Ladies' Swimming Pool Meadow (S2), and also recorded from tall herbs on Pryors Field (S5) and the meadow on West Heath (S7).

Gnaphosidae

Drassodes lapidosus (Walckenaer, 1802)
A single female trapped near the overgrown hedge north of Kite Hill (S1) in April 1997, but probably more widespread.

Drassodes cupreus (Blackwall, 1834)
A single female under old gorse at Sandy Heath (S8) in August 1995, and a male inside the Tumulus enclosure (S1) in June 2004.

Haplodrassus silvestris (Blackwall, 1833)
Two males trapped in June 2004, in a newly coppiced area in the central Woods (S5).

Scotophaeus blackwalli (Thorell, 1871)
Recorded by Savory and Le Gros (1957), but not recorded by other authors.

Zelotes latreillei (Simon, 1878)
Common in natural grassland areas where anthills have been allowed to remain or develop; frequent on the slopes above Vale of Health (S5), at Judges Hollow, West Heath (S7), the Bird Sanctuary (S2), Nettlebed (S5). The first record from Pryors Field (S5) was in August 2005, and only a single juvenile has been trapped on Tumulus Field (S1).

Zelotes ?apricorum (L.Koch, 1876)
A single subadult, probably *Z. apricorum*, trapped in undisturbed grassland at Hampstead Heath Extension (S9).

Drassyllus pusillus (C.L.Koch, 1833)
First recorded from Pryors Field in 2004, and subsequently individuals trapped at Judges Hollow (S7) and West Meadow, Kenwood (S4).

Micaria pulicaria (Sundevall, 1831)
Trapped frequently on slopes above Vale of Health (S6), and single individuals trapped in the Bird Sanctuary (S2), and under gorse at Sandy Heath (S8).

Zoridae

Zora spinimana (Sundevall, 1833)
First recorded by Russell-Smith (pers. comm.). Solitary individuals occasionally found under gorse, and at a number of other widely separated sites in long grass and scrub.

Micrommata virescens (Clerck, 1757)
Recorded by Albin (1736) at Kenwood, but not seen since; presumably extinct.

Philodromidae

Philodromus dispar Walckenaer, 1826
Occasionally swept from bushes and lower branches of trees in several parts of the Heath.

Philodromus aureolus (Clerck, 1757)
Occasionally swept from bushes.

Philodromus praedatus O.P.-Cambridge, 1871
A single male swept from lower branches of pines at the Tumulus (S1).

Philodromus cespitum (Walckenaer, 1802)
Occasionally swept from bushes.

Philodromus collinus C.L.Koch, 1835
A single male trapped under pines at the Tumulus (S1) in October 2002.

Tibellus oblongus (Walckenaer, 1802)
Only recorded three times; trapped in the Bird Sanctuary (S2) in April 2004, and twice in long grass at the north end of Hampstead Heath Extension in May 2003 and October 2005.

Thomisidae

Diaea dorsata (Fabricius, 1777)
Recorded by Albin (1736) but not seen since and presumably extinct.

***Xysticus cristatus* (Clerck, 1757)**
Not recorded by Savory and Le Gros (1957), but found in 1972 by Russell-Smith (1978). Now found in small numbers in all grassland areas but most commonly in longer grass.

Xysticus kochi Thorell, 1872
Frequently trapped in small numbers on Kite Hill, otherwise only on Cohen's Fields (S3), at Westfield Bog and West Meadow, Kenwood (S4).

Ozyptila sanctuaria (O.P.-Cambridge, 1871)
Single individuals trapped at four different sites in short grass in different parts of the Heath.

Ozyptila praticola (C.L. Koch, 1937)
Occurring in considerable numbers inside the Tumulus enclosure (S1) and also occurring in an old elm thicket on Kite Hill (S1); otherwise recorded only from Preacher's Hill (S6) and an old hedge north of Kite Hill (S1).

Ozyptila trux (Blackwall, 1846)
A single female trapped on Kite Hill (S1) in June 2005.

Ozyptila simplex (O.P.-Cambridge, 1862)
Occasionally trapped in grassland at seven sites in different parts of the Heath.

Salticidae

Salticus scenicus (Clerck, 1757)
Recorded by Savory and Le Gros (1957), and swept from bushes at Vale of Health (S5) in June 2005.

Heliophanus flavipes (Hahn, 1832)
Individuals frequently trapped on Vale of Health (S5) slopes, and also occasionally at Judges Hollow (S7) but not elsewhere.

Marpissa muscosa (Clerck, 1757)
A single male trapped below pine trees at the Tumulus (S1) in June 2003.

Euophrys frontalis (Walckenaer, 1802)
Frequently found in small numbers on Vale of Health slopes and much less frequently at other grassland sites including tussock grassland in the Bird Sanctuary (S2) and under old gorse at Sandy Heath (S8), but not recorded from Hampstead Heath Extension.

Talavera aequipes (O.P.-Cambridge, 1871)
Only known from two sites; frequently trapped on south-facing grassy slopes above the Vale of Health (S5), and a single female trapped on Pryors Field (S6) in September 1995.

SPIDER PARASITES

Hymenoptera: Ichneumonidae

Acrodactyla degener (Haliday, 1838)
This small parasitic wasp, whose larva is a creamy coloured 'rider' on the abdomen of small spiders, had been found on *Lepthyphantes* spp. occasionally on Sandy Heath (S8).

Discussion and conclusions

The current list reflects in part the nature of the collecting effort that has produced the data. By far the greatest effort has been put into searching and trapping grassland, and the least into investigating trees; relatively little searching under bark has been undertaken or sweep-netting the lower branches of trees, while the upper canopy has not been investigated at all. Findings on the ground under the pines at the Tumulus suggest that beating the foliage of these trees could be very rewarding if it could be arranged. The few records of species such as *Amaurobius* spp., *Oonops* spp. and several theridiids bear witness to these gaps in the collecting effort. There are a few bark-inhabiting species such as *Moebilia penicillata* which have been found in nearby woods (Highgate Wood, Queen's Wood, etc.). These species almost certainly occur on the Heath but have not yet been found. Others such as *Paidiscura pallens* and *Scotophaeus blackwalli* are among the twenty-nine species which have not been recorded for at least ten years (Appendix). A few species may have disappeared recently; examples could be *Bathyphantes nigrinus* and *Troxochrus scabriculus*, but actual extinction is impossible to confirm except for larger species, and in any case, some small spiders can apparently survive at very low population densities.

Some conclusions can be drawn from the data available; the spider fauna of the Heath has changed and will continue to do so, and this process may accelerate under the influence of climate change. Some species have disappeared, others appear to have become scarcer, while yet others appear to have arrived for the first time or become much commoner. There is a continuing eutrophication of all habitats on the Heath, and this has supplanted the acidification that was caused for a century or more by the deposition of high levels of sulphur and nitrogen. In the long term, additional nitrogen and phosphorus compounds may be just as damaging, by altering the predominant vegetation structure. On the other hand the management strategy for the Heath has been, and will continue to be, most influential. In some aspects this is positive, but in others negative. Detailed plans for the future management of the Heath are currently being prepared, but the existing management plan (Corporation of London 2001) surprisingly makes no reference to pollution or its effects. However, specific consideration is given to conservation of particular habitats, such as of natural grassland, which has certainly benefited in recent years from more sensitive management.

Some of the key management problems are yet to be seriously addressed. In many areas, vigorously competitive species such as *Rubus* spp., *Urtica dioica* and *Cirsium arvense* have increased in area enormously. While these are all important plants for both invertebrates and birds, the balance has shifted in many places away from fine-leaved grasses, to thickets of these species; this is particularly visible near some of the roads crossing the Heath. Most of the grassland is more or less invaded by areas of *Holcus* spp., so that the areas dominated by *Festuca* spp. seem to get smaller every year; on the west side of Kite Hill only very small patches now remain where just a few years ago the *Festuca* sward was extensive. Bramble *Rubus* spp. has been allowed to run riot in many areas; on revisiting some pitfall-trap sites that were sampled as *Festuca*-dominated woodland glades in the late 1990s the author found that the actual grassy sites had disappeared completely under dense thickets of bramble.

In the author's view, the use of flailing machines to cut back rank vegetation, especially bramble, is counterproductive; it frequently results in the premature and uncontrollable development of dense bramble patches, which cannot be restricted except by hand cutting or removal of the roots. The west side of Kite Hill is a particularly serious example of this process.

The subjection of major areas of grassland to heavy mowing machines, sometimes in damp conditions, has caused damaging compaction and homogenization over a number of years; this still continues in some areas.

The ecological importance and value of anthills in grassland has been pointed out by Kirby (1992) and discussed in some detail by King (2006) who states unequivocally that old grasslands with anthills should not be mown mechanically, and after pointing out that anthills do not occur in mown hay meadows, urges that 'management plans should take anthills more into account.' Today, most management operations on the Heath are done with machines, only leaving certain specific jobs such as the removal of thistles and oak saplings to be done by hand — and this almost entirely by volunteers.

There has been a relaxation of mowing pressure on some of the grassland. The present condition of the Ladies' Swimming Pool Meadow is an excellent example of what can be achieved a just a few years by restricting mowing to a few key desire-lines combined with some thistle removal; many orb-web spiders (at least 7 spp.) now thrive on the meadow, and there is an encouraging development of surface irregularities including anthills, tussock formation etc. In other places (though not yet on Ladies' Swimming Pool Meadow) ant-associated species have benefited, so that *Zelotes latreillei*, which was extremely scarce on the Heath just a few years ago, is now widespread and fairly common. Other ant-associated species can be expected to become more widespread in the future.

Nutrient levels continue to rise. Dog waste is still only partly controlled; 'dog owners' (professional dog-walkers not being mentioned) only being '*encouraged* to clear up . . . faeces' (author's italics) (Corporation of London 2001: 42). This problem needs serious attention.

Within living memory cattle were grazed on some parts of the Heath, and in the more distant past, sheep. In the 1960s, several species of ground-nesting birds such as larks and lapwings were present; perhaps it would require enclosure of some areas for this to be recovered. If grazing, by sheep or especially by cattle, could be reintroduced (as has been successfully done in some other urban and peri-urban areas), this would bring considerable benefit to the grassland habitats.

Some of the marshy areas have become very shaded, causing existing habitats to deteriorate, impoverishing the spider fauna. At West Field Bog (Kenwood) this process was reversed some years ago with the removal of a fringing ring of self-seeded birches. There is some doubt as to whether this was too drastic a measure, as at least some of the *Sphagnum* spp. occurring there thrive under light shade. However, the growth of some species of *Sphagnum* has been very vigorous in the last two years at least. Although the spider fauna is unspectacular, it is a clearly marshland assemblage with species such as *Lophomma punctatum* and *Antistea elegans* present. There is still some concern about whether this *Sphagnum* fen is drying up, and there are some proposed changes in management to allow greater water retention, especially in the summer, which should certainly benefit the spider fauna, but the shading problem has receded.

There is currently far less marshland on the Heath than in earlier times. Management of most parts of the Heath appears to have started in the nineteenth century with the idea of 'improving' the drainage, including the creation of Vale of Health pond on what was previously a large marshy area. Currently most of the streams flow too quickly for any adjacent wetland fringes to develop, even where the watercourses are not heavily shaded; the relative scarcity of marshland spiders is due to the removal of much of their habitat. However, some new wetland patches have been created in the last few years, by obstructing the flow of specific streams, and three small *Phragmites* beds have been planted.

Much of the woodland now has a closed canopy but encouragingly some limited coppicing has been restarted, and the woodland species can only benefit from the extension of this management. The discovery of *Haplodrassus silvestris* in one of the newly coppiced areas was most encouraging; it is possible that other woodland specialist species are still hanging on undetected, but in very small numbers.

As with bryophytes, there has been the discovery of quite a number of previously unrecorded spiders in recent years. Since 2000, seven species of orb-web spiders have been recorded on the Heath for the first time, four of them on the now unmown Ladies' Swimming Pool Meadow. Four other spiders (not orb-web spinners) have been recorded for the first time at the Tumulus (including the bark-dwelling *Marpissa muscosa* and two species of *Philodromus* living in pine foliage). In the same period twelve additional species have been recorded from the grassland.

Pitfall-trapping in grassland on the Heath was conducted at more or less the same level since 1991 up to the end of 2005, and yet new species are still being found even at sites that have been trapped for many years. *Drassyllus pusillus*, an ant-associated species, has appeared on Pryors Field; *Ozyptila trux*, a tiny crab-spider has appeared for the first time on Kite Hill, and *Dicymbium nigrum* (as distinct from the very similar *D. brevisetosum*) has been found on the Tumulus Field, all since 2002. Were these species there all the time but occurring in such small numbers that they were not found? Or have they appeared by chance or due to changes in the habitat? Evidence from green roofs (G. Kados, pers. comm.) suggests that quite specialized species such as *Bianor aurocinctus* and *Steatoda phalerata* can quickly find their way to newly created dry grassland habitats even in urban areas. (The habitat suitable for both these species still exists on the south-facing slopes above Vale of Health although they have yet to be recorded on the Heath.)

It is notoriously difficult to predict future discoveries, and as considerable effort has already been put into spider collecting on the Heath it is thought unlikely that the species list will increase very much in the near future, but some species that occur in very small numbers may well appear for the first time. In the woodland it is quite possible that *Micrommata virescens* will be found, and on the Vale of Health slopes or Pryors Field, *Diaea dorsata* may even reappear.

How many species actually live on the Heath? This is not a question with a fixed answer. Some new species are likely to be added as more southern species extend their range northwards due to climate change, and in any case (as discussed above) the habitat of the Heath itself continues to change. It has been suggested that the spread of *Argiope bruennichi* away from the south coast in recent years (Harvey et al. 2002) is due in part to climate change, but an equally important factor may be the changes in the management of many open spaces allowing larger populations of grasshoppers and crickets (Orthoptera), the preferred prey, to build up. Further reductions in pollution would certainly help shift the ecological balance back towards increased diversity, and there is a possibility that some grassland specialists such as *Steatoda phalerata* may then appear.

Perhaps the most important influence in the short to medium term, is the strategy adopted for management of the Heath, especially if serious attempts are made to reduce current trends towards eutrophication which otherwise will inevitably lead to more standardization or homogenization of the habitat. It is hoped that policies continue to be implemented which aim to improve the quality and diversity of all habitats on the Heath. The overall result should be to increase in spider diversity by the successful colonization (the most recent being *Mangora acalypha* in May 2006), and likely establishment of new species arriving from other localities in and around the London area.

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APPENDIX

List of species with first published record and author, and recorded occurrence in each Sector

Col. 1: A = Albin (1736), En = Enock (1885) , S = Smith (1901), E = Ellison (1913), B = Bristowe (1929), SL = Savory and Le Gros (1957).

Col. 2: × = Russell-Smith (1978), u = Russell-Smith (pers. comm.1972).

Col. 3: M(1) = Milner: 1987, M(2) = 1991 , M(3) = 1992, M(4) = 1993, M(5) = 1994, M(6) = 1995*a*, M(7) = 1995*b*, M(8) = 1996, M(9) = 1997, M(10) = 1998, M(11) = 1999, M(12) = 2002, M(13) = 2003, M(14) = 2004, M(15) = 2005, M(16) = 2006.

NS = recorded but no Sector indicated. S1–S9 = Sectors.

Species recorded from all 9 sectors given **in bold**.

(×) = thought to be extinct.

* = last record more than ten years ago (1995 or earlier) (29 spp.).

** A male specimen provisionally identified as *Centromerus incilium* was recorded from Tumulus Field in November 1995 (M(8)), but subsequent re-examination by Peter Merrett showed this was an error; it was identified as *Porrhomma microphthalmum*. *C. incilium* has yet to be recorded anywhere on the Heath.

	Col.	Col.	Col.	Sectors									
	1	2	3	NS	1	2	3	4	5	6	7	8	9
Atypus affinis	E		M(6)						×				
Psilochorus simoni			*						×				
Dysdera crocata					×	×							
Harpactea hombergi					×					×		×	×
Oonops pulcher		u		×									
Oonops domesticus	SL		M(6)						×				
Ero cambridgei	S	M(1)*			×			×					
Ero furcata		M(5)		×	×	×	×	×	×	×	×	×	×
Nesticus cellulanus		*						×					
Steatoda bipunctata	S											×	
Anelosimus vittatus			M(5)		×	×			×		×	×	×
Theridion sisyphium	SL		M(5)						×		×	×	×
Theridion varians			M(4)					×				×	×
Theridion familiare			M(11)*								×		
Theridion melanurum		u	*	×									
Theridion mystaceum						×						×	
Theridion tinctum		u				×			×		×	×	
Neottiura bimaculatum	SL	u				×			×	×	×	×	×
Paidiscura pallens			*									×	×

	Col.	Col.	Col.	Sectors									
	1	2	3	NS	1	2	3	4	5	6	7	8	9
Enoplognatha ovata s. s.		u			×		×		×	×	×	×	×
Enoplognatha latimana			M(9)			×				×			
Enoplognatha thoracica		×			×	×	×	×	×	×	×		×
Robertus lividus		u			×	×	×	×	×	×	×	×	×
Robertus arundineti			M(16)					×		×			
Pholcomma gibbum									×	×	×		×
Ceratinella brevipes		×			×				×			×	
Walckenaeria acuminata		u			×	×	×	×	×	×	×	×	×
Walckenaeria antica		u			×	×	×	×	×	×	×	×	×
Walckenaeria cucullata			M(2)		×	×			×	×	×	×	×
Walckenaeria atrotibialis					×	×	×	×	×	×	×		×
Walckenaeria nudipalpis		×			×	×	×	×	×	×	×		×
Walckenaeria unicornis		u				×			×	×			
Walckenaeria cuspidata		u	M(4)*					×					
'Dicymbium nigrum'	B			×									
Dicymbium nigrum s. s.		×	M(13)		×				×				
Dicymbium brevisetosum		×	M(1)		×	×	×	×	×	×	×	×	×
Entelecara congenera			M(7)						×			×	
Entelecara erythropus		u		×									
Gnathonarium dentatum						×	×	×	×		×	×	×
Gongylidium rufipes					×	×	×		×	×	×	×	×
Dismodicus bifrons					×	×	×	×		×			×
Hypomma bituberculatum					×	×		×		×			×
Maso sundevalli		u	M(1)		×	×	×	×	×	×	×	×	×
Pocadicnemis pumila		×							×				×
Pocadicnemis juncea		u	M(5)		×	×	×	×	×	×	×	×	×
Oedothorax gibbosus		×			×	×	×	×	×	×	×		×
Oedothorax fuscus		×			×	×	×	×	×	×	×		×
Oedothorax agrestis							×				×		
Oedothorax retusus					×	×	×	×	×	×	×		×
Pelecopsis parallela					×			×	×		×		
Cnephalocotes obscurus		u			×			×	×	×	×	×	×
Ceratinopsis stativa		×	M(10)					×		×	×		×
Tiso vagans					×	×	×	×	×	×	×	×	×
Troxochrus scabriculus		u	M(4)*							×			
Tapinocyba praecox		×	M(4)		×	×	×	×	×	×	×		×
Tapinocyba insecta		×	M(2)*					×					
Tapinocyboides pygmaeus			M(3)		×			×		×			
Monocephalus fuscipes		×			×	×	×	×	×	×	×	×	×
Lophomma punctatum		×				×	×	×	×		×	×	×
Gongylidiellum vivum		×			×	×	×	×	×	×	×	×	×
Micrargus herbigradus		×			×	×	×	×	×	×	×	×	×
Micrargus subaequalis			M(4)		×				×	×	×	×	×
Erigonella hiemalis					×	×		×	×	×	×		×
Savignia frontata		u			×	×	×						
Diplocephalus cristatus			*						×				
Diplocephalus permixtus		×				×	×	×	×		×	×	
Diplocephalus latifrons		u			×	×		×	×	×	×	×	×
Diplocephalus picinus		×			×	×	×	×	×	×	×	×	×
Araeoncus humilis					×								
Panamomops sulcifrons		×	M(4)		×	×			×	×			×
Typhochrestus digitatus			M(1)	×									
Milleriana inerrans			M(1)		×	×	×	×	×	×			
Erigone dentipalpis	B	u			×	×	×	×	×	×	×	×	×
Erigone atra	SL	u			×	×	×	×	×	×	×		×
Leptorhoptrum robustum		×			×	×	×		×	×	×		×
Jacksonella falconeri			M(16)								×		
Porrhomma pygmaeum			M(1) *										×

	Col.	Col.	Col.	Sectors									
	1	2	3	NS	1	2	3	4	5	6	7	8	9
Porrhomma campbelli			M(1)		×	×			×	×			
Porrhomma microphthalmum			M(2)		×	×	×	×		×	×		
Agyneta conigera			M(8)*						×				
Agyneta decora			M(8)		×	×	×	×	×	×	×	×	×
Meioneta rurestris			M(1)		×	×	×	×	×	×	×		×
Meioneta mollis			M(9)							×			
Meioneta saxatilis		×			×	×	×	×	×	×	×	×	×
Meioneta beata					×	×		×	×	×	×		×
Microneta viaria	SL	×			×	×	×	×	×	×	×	×	×
Centromerus sylvaticus		×			×	×	×	×	×	×	×	×	×
*(Centromerus incilium)***			M(8)										
Centromerus dilutus			M(5)		×		×	×	×		×	×	×
Tallusia experta		×				×	×				×		×
Centromerita bicolor			M(4)		×	×	×	×	×	×	×	×	×
Centromerita concinna			M(5)		×	×	×	×	×		×	×	
Saaristoa abnormis		×			×	×	×	×	×	×	×	×	
Macrargus rufus			M(1)		×	×	×	×	×	×	×	×	×
Bathyphantes approximatus		×				×	×				×	×	×
Bathyphantes gracilis	SL	×			×	×	×	×	×	×	×	×	×
Bathyphantes parvulus		×			×	×	×	×	×	×	×	×	×
Bathyphantes nigrinus			M(1) *	×									
Kaestneria pullata		×		×									
Diplostyla concolor			M(5)		×	×	×	×	×	×	×	×	×
Tapinopa longidens			M(4)		×	×		×	×	×	×		×
Floronia bucculenta			M(13)		×								
Taranucnus setosus			M(4) *	×									
Labulla thoracica	SL		M(1)*	×									
Stemonyphantes lineatus		u			×	×	×		×	×	×	×	×
Lepthyphantes nebulosus	SL	u	*	×									
Lepthyphantes minutus			M(1)					×	×	×			
Lepthyphantes alacris			M(4) *					×					
Lepthyphantes obscurus		×	*						×				
Lepthyphantes tenuis	B	u			×	×	×	×	×	×	×	×	×
Lepthyphantes zimmermanni		×			×	×	×	×	×	×	×	×	×
Lepthyphantes cristatus		×	*	×									
Lepthyphantes mengei			M(4)		×	×		×	×	×	×	×	×
Lepthyphantes flavipes		u			×	×	×	×	×	×	×	×	×
Lepthyphantes ericaeus		×			×	×	×	×	×	×	×	×	×
Lepthyphantes pallidus			M(5)		×	×	×	×	×	×	×	×	×
Lepthyphantes insignis			M(3)		×			×	×	×			
Helophora insignis		u					×	×	×			×	
Linyphia triangularis	SL	u				×	×		×		×	×	
Linyphia hortensis	SL	u			×		×		×	×		×	×
Neriene montana		u	*	×									
Neriene clathrata	SL	u			×	×	×		×	×	×	×	×
Neriene peltata		u				×			×				×
Microlinyphia pusilla	SL							×				×	
Tetragnatha extensa					×								
Tetragnatha pinicola						×							
Tetragnatha montana					×	×	×		×				
Tetragnatha obtusa			M(10)			×							
Pachygnatha clercki	B	u			×	×	×	×	×	×	×	×	×
Pachygnatha degeeri	B		M(1)		×	×	×	×	×	×	×	×	×
Metellina segmentata		u				×	×		×	×	×	×	×
Metellina mengei		u				×		×	×	×			
Zygiella x-notata													×
Zygiella atrica	SL		*			×							
Gibbaranea gibbosa		×	*										×

	Col.	Col.	Col.	Sectors									
	1	2	3	NS	1	2	3	4	5	6	7	8	9
Araneus diadematus	E					×		×		×			
Araneus quadratus			M(3)			×	×						×
Araneus marmoreus	A		*					(×)					
Larinioides cornutus			M(12)		×	×							
Nuctenea umbratica			M(4)		×			×				×	
Agalenatea redii			M(12)			×	×			×		×	
Neoscona adianta			M(12)			×							
Araniella cucurbitina	B	u			×	×			×		×		
Araniella opisthographa			M(9)							×			
Zilla diodia			M(13)									×	×
Mangora acalypha			M(16)									×	
Hypsosinga pygmaea			M(8)		×	×	×	×	×				
Cyclosa conica			M(7) *									×	
Argiope bruennichi			M(13)			×	×	×		×	×		
Pardosa palustris			M(4)		×	×	×	×	×	×	×	×	×
Pardosa pullata		u			×	×	×	×	×	×	×	×	×
Pardosa prativaga		u			×	×	×	×	×	×		×	×
Pardosa amentata		×			×	×	×	×	×	×	×	×	×
Pardosa nigriceps			M(11)		×			×		×			
Pardosa saltans			M(4)				×	×	×	×		×	
Alopecosa pulverulenta			M(4)		×	×	×	×	×	×	×	×	×
Alopecosa cuneata			M(2)		×		×		×	×			
Trochosa ruricola			M(1)		×	×	×		×	×	×		×
Trochosa terricola					×	×	×	×	×	×	×	×	×
Pirata piraticus		×				×	×	×	×			×	
Pirata hygrophilus			M(8)				×	×					
Pirata uliginosus			M(10)					×		×	×		×
Pirata latitans			M(9)			×		×	×	×			
Pisaura mirabilis	A		M(1)		×	×	×		×	×		×	×
Agelena labyrinthica	SL		M(13)			×							
Tegenaria gigantea			M(4)		×		×	×	×				
Tegenaria atrica	SL		*					×					
Tegenaria silvestris			M(4)					×					
Antistea elegans		×				×	×	×	×		×	×	×
Hahnia nava					×	×		×	×	×	×		×
Dictyna arundinacea						×		×	×				
Dictyna uncinata		u				×			×	×	×	×	
Nigma walckenaeri					×								
Cicurina cicur					×	×		×					
Lathys humilis			M(11)						×			×	
Amaurobius fenestralis												×	
Amaurobius similis					×				×			×	
Amaurobius ferox					×						×		
Coelotes atropos			M(8) *				×						
Coelotes terrestris							×						
Anyphaena accentuata												×	
Phrurolithus festivus			M(4)		×	×			×		×	×	×
Clubiona corticalis		u			×			×	×				
Clubiona reclusa		u			×	×	×	×	×	×	×	×	×
Clubiona stagnatilis			M(11)							×	×		
Clubiona phragmitis						×				×			×
Clubiona terrestris	SL				×	×	×	×	×	×	×	×	×
Clubiona lutescens		×				×	×		×		×	×	×
Clubiona comta	SL				×	×		×	×		×	×	×
Clubiona brevipes			M(1)		×				×				
Clubiona diversa					×						×		
Cheiracanthium erraticum			M(8)			×				×	×		
Drassodes lapidosus			M(1)		×								

	Col.	Col.	Col.	Sectors									
	1	2	3	NS	1	2	3	4	5	6	7	8	9
Drassodes cupreus					×							×	
Haplodrassus silvestris			M(15)						×				
Scotophaeus blackwalli	SL	u	*	×									
Zelotes latreillei			M(9)		×	×			×	×	×		
Zelotes ?apricorum			M(10)										×
Drassyllus pusillus								×		×	×		
Micaria pulicaria			M(4)			×			×			×	
Zora spinimana		u				×			×		×	×	×
Micrommata virescens	A		*					×					
Philodromus dispar			M(4)			×		×	×		×		
Philodromus aureolus			M(1)		×	×			×				
Philodromus praedatus		×	M(13)		×							×	
Philodromus cespitum			M(4)					×		×	×		
Philodromus collinus			M(13)		×								
Tibellus oblongus		u			×								×
Diaea dorsata	A		*					×					
Xysticus cristatus		×			×	×	×	×	×	×	×	×	×
Xysticus kochi			M(8)		×		×	×					
Ozyptila sanctuaria			M(9)		×		×		×	×			
Ozyptila praticola					×					×			
Ozyptila trux					×								
Ozyptila simplex			M(13)		×	×		×		×			×
Salticus scenicus	SL								×				
Heliophanus flavipes			M(8)						×		×	×	
Marpissa muscosa			M(14)		×								
Euophrys frontalis			M(4)		×	×			×	×	×	×	
Talavera aequipes			M(8)						×	×			
Acrodactyla degener			?									×	

Book review

Change in the British flora 1987–2004. (A report on the BSBI Local Change survey). M. E. Braithwaite, R. W. Ellis and C. D. Preston. Botanical Society of the British Isles. 2006. 382 pp., paperback. ISBN 0 90115 34 8. Available from Summerfield Books, Main Street, Brough, Cumbria CA17 4AX. £12 plus £3.50 p.&p. in UK.

This is a 382-page report and analysis of the findings of the Local Change (LC) project undertaken by the BSBI between 2003 and 2004 in an attempt to quantify alterations in the flora resulting from changes in climate and land use using as a baseline the Monitoring Scheme (MS) undertaken in 1987–1988. The tetrads chosen in the earlier survey are re-recorded but the authors admit that there are many inconsistencies, not least the facts that the recorders in each survey were mostly different, the detection and taxonomic skills of recorders are inevitably variable, as discussed in Chapter 7, and recording in LC was more intense than in MS. The analysis attempts to minimize the effect of all the variables to give statistically meaningful results. The study uses as a basis groups of species populating the Broad Habitats defined in the UK Biodiversity Action Plan in 2000, although these habitats are further subdivided using a classification based on the distribution of the component species. The groups were created using a TWINSPAN analysis (a method of measuring differences between species) and named after one of the members. Species included were chosen with great care. Both common and rare plants are excluded because the former do not give reliable Change Factors and there are too few data for the latter. Natives and archaeophytes are dealt with separately from aliens and neophytes.

The book is laid out more or less on the lines of a scientific paper, beginning with an executive summary, an introduction and then the methods used for both the survey and the analysis of the results. The results for each Broad Habitat follow. A description is given for each habitat, then the changes that have occurred in the period 1950 to 2004 and the factors which led to them, a brief summary of any earlier studies, and tables and charts of changes in relation to Ellenberg factors. Changes for all species in each TWINSPAN group are tabulated and 'case studies' presented for a few selected ones from each, consisting of a map showing the change for each tetrad superimposed on the distribution as recorded for *Atlas 2000* with a brief commentary. There are chapters dealing with plants not included elsewhere in the book and other aspects of recording. The last chapter is the authors' conclusions and recommendations, one being a repetition of the project in about fifteen years' time.

This is a professionally written, technical book and careful reading of the introductory chapters is essential to make the most of the habitat accounts. It is full of information, systematically laid out and covers all aspects of the survey, including its limitations. The statistical methods used are explained but would not make easy reading for most people. There are many photographs of plants and places (and a very few people) which add nothing to the stated purpose of the book but make it more attractive and give context to the subject under discussion. The distribution maps in the case studies give an at-a-glance picture of change and although more would have been interesting they would have made the book considerably larger and the concern is with trends rather than individual species. The page index for species is not in the traditional place at the end of the book but hidden in a table in Appendix 1, some forty pages back, although if you read thoroughly enough the Table of Contents you would discover that.

Having established that change is occurring, is it necessary, possible or desirable to do anything about it? A question about which volumes might be written, but NNRs and Conservation Areas have been established during the last fifty years to provide refuges and to protect species from local threats in order to preserve the diversity of the British flora. The authors have done a thorough job with a difficult task. This book is a valuable resource for both those concerned with conservation and all with an interest in the development of the British flora.

GEORGE HOUNSOME

The establishment of the rosemary beetle *Chrysolina americana* (L.) in London, 1998–2005

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Summary

The arrival and establishment of the rosemary beetle in London and the rest of UK is described. The value of the general public (especially gardeners) in recording is noted.

Colonization

Chrysolina americana is a chrysomelid beetle native to the Mediterranean basin and the Middle East where rosemary *Rosmarinus officinalis* is its primary host although it is also commonly found on lavender *Lavandula officinalis* (Balachowsky 1963). It is a distinctive metallic, multicoloured, domed beetle, 6–8 mm long. It was first found in Britain during 1963 in Cheshire (Johnson 1963), possibly unintentionally imported from Portugal. During 1994 there was evidence of breeding on plants at the Royal Horticultural Society's (RHS) Garden Wisley (Halstead 1996) but none survived subsequently although during 1998 specimens were found in Berkshire, Leicestershire and near the Shell Building, Waterloo. There were few records in the next few years but these included Ian Menzies' first Middlesex find at Millbank in 1999, an enquiry made to the RHS in 1999 from Weybridge and Ian Swinney's at Bookham Common in 2000.

During 2001–2 there were twenty-three reports, mostly from central London, north Surrey and west Middlesex but including Dan Hackett's South Essex (VC18) find at Springfield Marina in 2001. Barclay and Mann (2002) described several London populations. Some observations were by entomologists but increasingly included submissions of plant pests to the RHS members' advisory service.

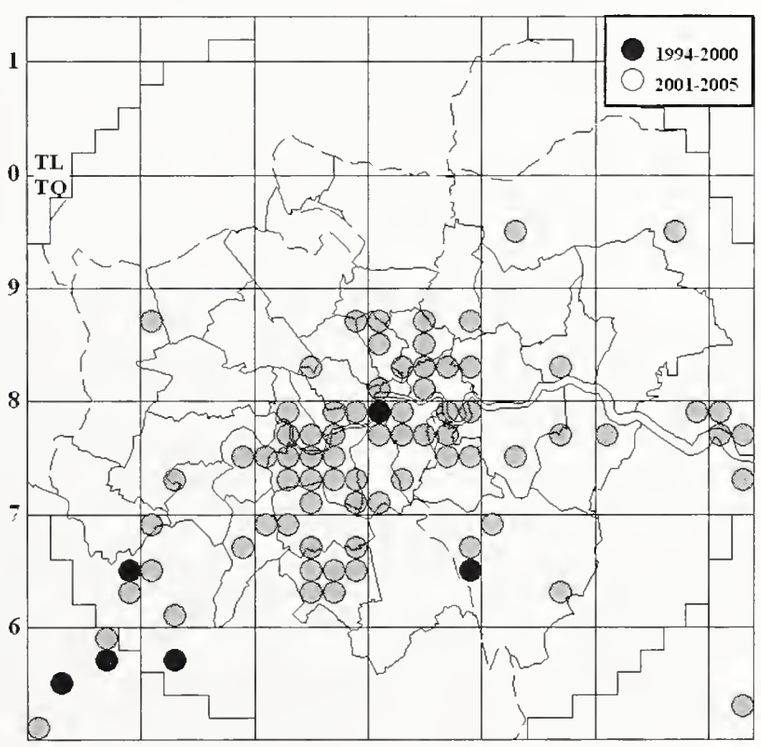

FIGURE 1. *Chrysolina americana* in London and surrounding areas.

In subsequent years the beetle has become widespread and numerous in London and is now found in many of the surrounding counties, including first observations for Hertfordshire at Sawbridgeworth in 2002 and West Kent (VC16) at Beckenham in 2003. There have, to date, been no records from North Essex (VC19) (Mabbott 2006). Figure 1 shows the distribution of the beetle in London and adjacent areas to date.

Outside of the London area the beetle has been established in Norwich since 2002 (Salisbury 2002) and the beetle has been reported to the RHS or Essex Field Club from Breconshire (2005), Hampshire (2005), East and West Sussex (2003–4), East Kent (2004–5), Suffolk (2005), Cambridgeshire (2003), Shropshire (2005), Leicestershire (1998, 2004) and Edinburgh (2004). In 2005 the beetle entered the top ten enquired-about pests (at number 4) for the first time. Records received from RHS members and, since 2004, via the Essex Field Club website (www.essexfieldclub.org.uk) have proved a valuable source of data enabling the spread of this species to be tracked and providing information on the beetle's host range and phenology. Figure. 2 shows the national distribution to the end of 2005.

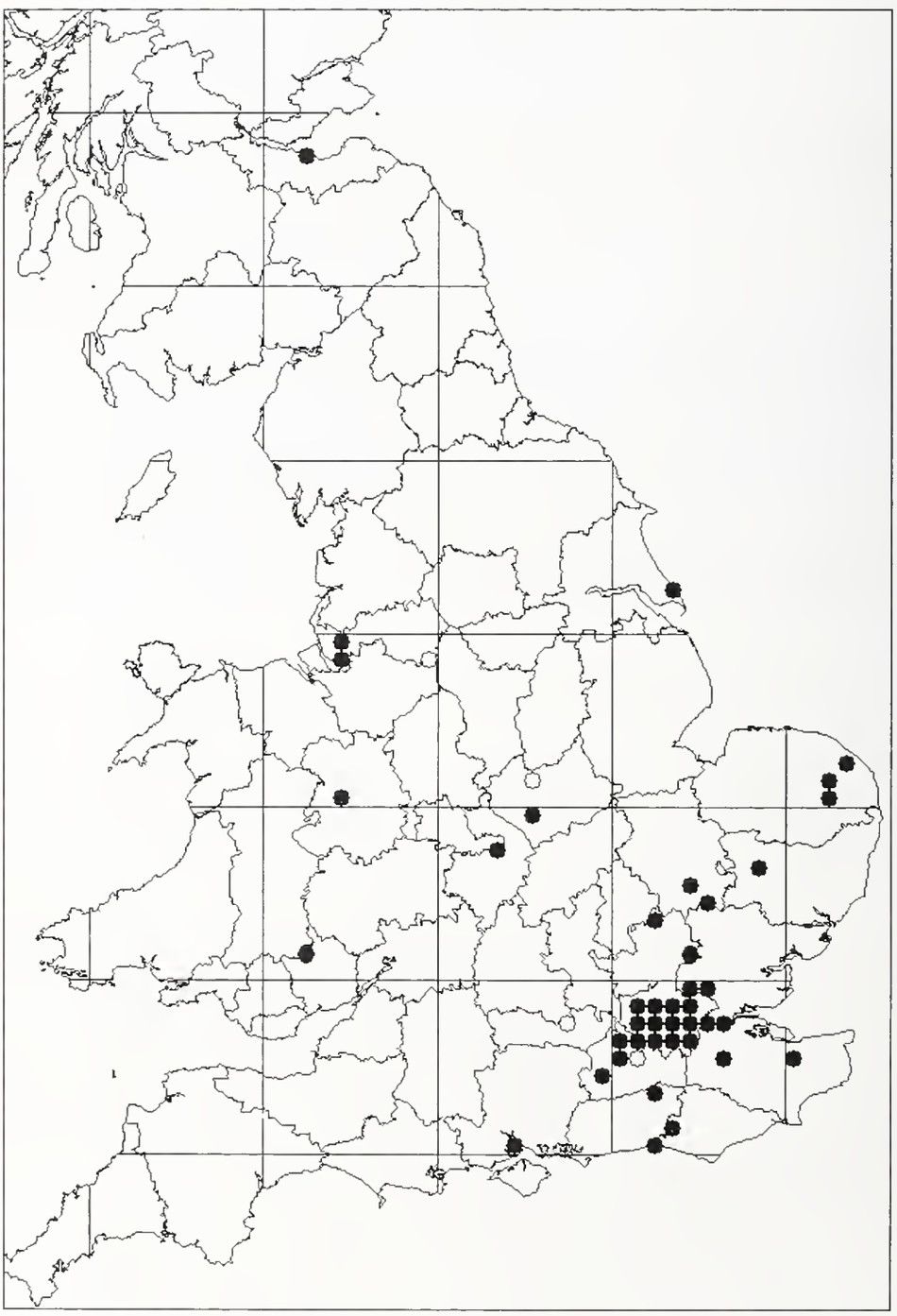

FIGURE 2. *Chrysolina americana* in UK to 2005.

Whilst initial colonies and some of the beetle's distribution are likely to be due to the import and movement of plant material, it is probable that at the local level the beetle is distributing by flight although this is seldom observed.

Behaviour

The adult (Figure 3) has been observed predominantly from May to June (Figure 4), however reports to the RHS indicate that the beetle can be active during any month of the year, at least two of the November–December finds were indoors and one was on plants imported from the Mediterranean. Many of the colonies are large; early life stages are not well reported but late larval instars and pupae have been observed between autumn and early summer, larvae were observed on plants in late January 2006 at Wisley Garden (Andrew Halstead pers. comm.). Most beetles were feeding on rosemary or lavender although there have been several reports from sage *Salvia* spp. and thyme *Thymus* spp. Several species of lavender are cultivated: where the species has been identified, the plant affected has been *Lavandula angustifolia* Mill. It has not been reported from the commonly grown butterfly lavender *L. stoechas* L.; indeed plants of this amongst infested rosemary seem to have been unscathed. However, there have been limited numbers of observations; other labiate species might be potential hosts.

FIGURE 3. *Chrysolina americana* on lavender, × 10. *Photo: Dan Wrench*

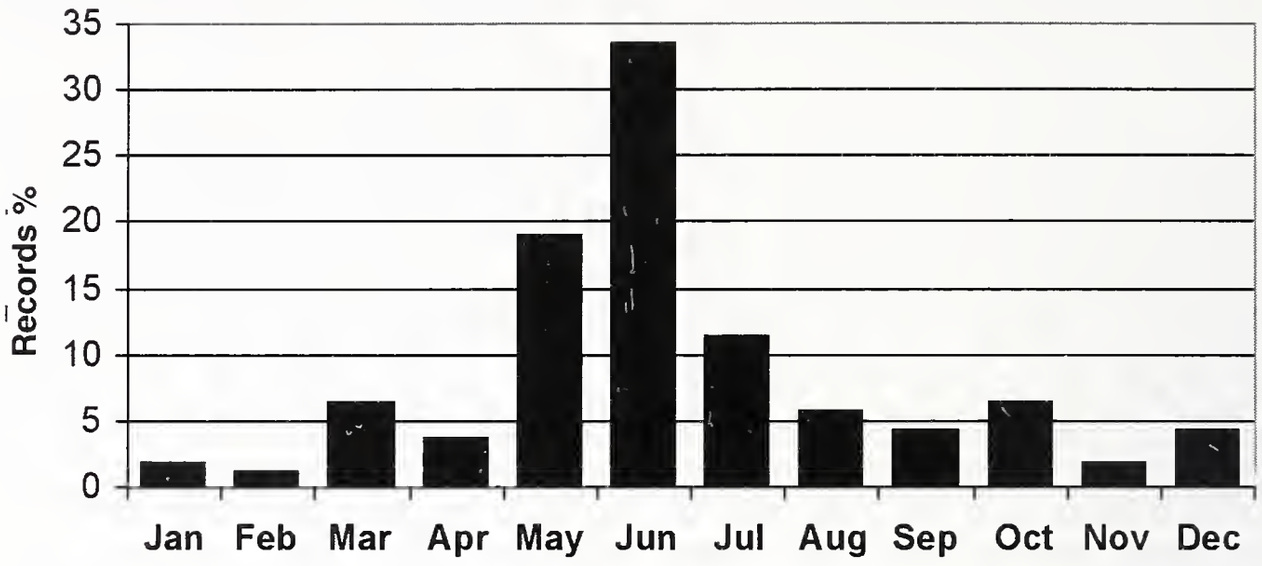

FIGURE 4. Monthly records as percentage of annual total.

Conclusion

Chrysolina americana is now well established in London and the surrounding area and has become a serious problem for lavender and rosemary growers. It has survived the cooler winter of 2005/6 and has spread further. Its dispersal and behaviour will continue to be monitored with the invaluable help of gardeners.

Acknowledgements

Our thanks to all those who contributed records and to Peter Harvey for maintaining the Essex Field Club web-site. Maps produced using *DMap* written by Alan Morton with London parameters by Colin Plant.

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Spider records for 2005 for the counties of London and Middlesex

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Abstract

New and interesting spider records for the counties of London and Middlesex in 2004 are detailed. There were three new records for London county and two new records for Middlesex.

Introduction

In 2005 altogether 192 species were recorded in the two counties of London and Middlesex (compared with 180 in 2004), of which three were new to London and two were new to Middlesex.

The Society held spider forays at Syon Park on 8 May, and Yeading Meadows on the Late Summer Holiday, 29 August. Neither was particularly successful; at Syon Park, owing, it was thought, to the late spring, there were very few spiders at all in the water meadows, although a single specimen of *Tapinocyboides pygmaeus* was found among *Festuca* stems on a dry grassy bank (see below). As spider recorder, the author also led spider forays at Mile End Park on 22 May, at Bedfont Lakes N R on 19 June, and a winter foray to Hampton Court, in the frost, on Sunday 4 December.

Pitfall trapping continued at Queen's Wood for the seventeenth consecutive year; and also at Mile End Park (London), Harmondsworth Moor and several sites near Heathrow Airport (Middlesex) including the constructed reedbeds and Camp 4 Conservation Area. Trapping continued at Hampstead Heath until the end of November when all spider survey and monitoring work on the Heath was halted. Pitfall-trapping for the year December 2004 to the end of November 2005 was conducted on behalf of English Nature on the Kenwood Estate including Westfield Bog, the only *Sphagnum* fen in the county of London.

Some pitfall trapping has been started at High Elms and Hayes Common (London Borough of Bromley) and briefly, in the early part of the year at three sites in Bexley.

In the list below those marked ** are new to London and those marked * new to Middlesex. All records are by the writer unless indicated. Trapped means pitfall-trapped unless otherwise stated. Nomenclature and the new order in the list of families are according to Merrett and Murphy (2000) with amendments in Harvey et al. (2002).

THERIDIIDAE

*Robertus arundineti***. Both sexes of the small tangle-web spider *Robertus arundineti* were trapped between May and July at Kenwood; on Pryors Field, Hampstead Heath; and also at Mile End Park. Surprisingly, this fairly common spider had not previously been recorded in London county.

LINYPHIIDAE

Tapinocyboides pygmaeus **RDB 3**. This rare spider is already known from three areas on Hampstead Heath where it is thriving; in April on Tumulus Field, eighteen males were taken at a single trap-site (three traps). It has now been taken on West Meadow and at Westfield Bog, both on the Kenwood Estate each month from December through to June (a total of sixteen males and one

female), and in April a single male was trapped on the west side of Kite Hill, Hampstead Heath.

In addition a single male was found by sorting tussocks of *Festuca* spp. at Syon Park during the Society's foray there in May. A single male was also trapped in neutral grassland at Foot's Cray Meadows in the London Borough of Bexley in February.

Perhaps its National Status as a *Red Data Book* species may soon be revised.

*Jacksonella falconeri***. A single male of this tiny, pale, money spider was taken in a pitfall trap at Judges Hollow on West Heath, Hampstead in January.

Syedra gracilis. This tiny money spider, reported for London for the first time last year, has now been recorded at Hounslow Heath near Heathrow Airport, when a single male was taken in a pitfall trap in neutral grassland in June.

LYCOSIDAE

*Pardosa proxima**. A single female of this scarce wolf spider was trapped in grass at Causeway Nature Reserve near Heathrow Airport in July.

Arctosa leopardus. This attractively marked wolf spider had only previously been recorded in London from green roofs in Dockland. In 2005 a single female was trapped on the ground near the pond at Mile End Park.

THOMISIDAE

*Ozyptila trux***. In June, a single female of this small crab spider was taken in a trap in a small area of *Festuca* spp. on the west side of Kite Hill, Hampstead.

GNAPHOSIDAE

Drassodes pubescens. Four male specimens of this rare gnaphosid spider were trapped on Hounslow Heath in July. This is not a new record for Middlesex but there was only one previous record; a female from Gunnersbury Triangle in 1988.

*Zelotes petrensis** Nationally Notable A. A total of four females of this rare ant-associated spider were trapped at three separate sites on Hounslow Heath in May. In fact with nine species recorded, the Heath is proving to be by far the richest site for Gnaphosidae in the whole London area.

SALTICIDAE

Bianor aurocinctus Nationally Notable A. A male specimen of this fine jumping spider was trapped at Mile End Park in July; as with *Arctosa leopardus,* this was the first record from the ground; it was previously only recorded from green roofs.

Acknowledgement

I would like to thank Dr Peter Merrett for identifying some of these specimens.

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London butterfly monitoring report for 2005

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Abstract

Butterflies were monitored by the use of transect walks at sites in London and data from over twenty transect sites were used to calculate collated indices for 2005. Records from some other sites in London are also presented.

Introduction

Monitoring of butterflies using a standard method continued at a number of sites throughout London in 2005. These provided data for the preparation of collated indices for changes in the abundance of butterfly species in London as compared with previous years. London is defined for the purposes of this paper as Greater London or the area encompassed by the London boroughs, though additional records from the wider London Natural History Society (LNHS) recording area are noted.

Methods

Monitoring was undertaken by the transect walk method, a standard method adopted throughout the United Kingdom. Details of the method are described elsewhere (see Pollard and Yates 1993, and Williams 2000 and the references cited there). Basically, at each site a walk was undertaken along the same route, each week, between April and September inclusive, within a standard range of weather conditions conducive to butterfly flight. Counts were made of the number of adult butterflies observed to provide a total for each species for the year at each transect. Totals used for this paper include calculated estimates for weeks missed due to poor weather or the unavailability of the recorders. However, for inclusion in the index, data from each transect needs to have been obtained with good coverage during the recording season and the minimum of missed weeks. Collated indices were calculated from the data as described by Williams (2000), but see also Crawford (1991) for an introduction to the use of collated indices in wildlife monitoring; and also Pollard and Yates (1993) and Roy and Rothery (2002). Note that neither the original site counts nor the collated indices are absolute counts of the population, but indices of abundance. The indices are relative from year to year, not from species to species. Estimates of the relative changes in the populations of each species from year to year are given by the difference in the indices. For example, a species with an index of 50 in one year and 25 in the following year would have had approximately half the adult population in the second year as compared with the first year. Indices have been rounded to the nearest whole number and have usually been set at 100 in 1990 or the first year of record: for a technical discussion see Crawford (1991). Reliability of the indices increases with the number of transects and there were relatively few transects in the earlier years, e.g. one transect was walked in 1978, two in 1986, three in 1988 and eight in 1990. Reliability of the indices may be lower for species with low counts and/or local distribution in London. The 'Total

count on transects' provides an indication of the size of the count from which the analysis was made in 2005 using the data from the complete transects for that species, including estimated counts for missing weeks; but excluding the computed estimated counts for transects that were not walked or had insufficient data in 2005.

Indices were collated from transects for which there was suitable data available for at least two years. At the time of writing, data was available from twenty-one transects that were walked in London with sufficient coverage in 2005. They are listed below with the years for which they contributed data. Data for previous years for both these and other sites is included in the index. The 2005 recorders are listed in the Acknowledgements. The borough in which the transect is located is given in parentheses: **Hampstead Heath** (Camden) 1978–2005, **Fryent Country Park** (Brent) 1986–2005, **Beane Hill** (Brent) 1988–2005, **Gutteridge Wood** (Hillingdon) 1990–2005, four transects managed by the Corporation of London (located in the London Borough of Croydon): **Coulsdon Common** 1990–2005, **Farthing Downs** 1990–2005, **Kenley Common** 1990–2005, **Riddlesdown** 1990–2005; **Clifford Road Allotments/New Barnet Allotments** (Barnet) 1994–1995, 1997–2005, **Mitcham Common 'route A'** (Merton) 1994–2001, 2003–2005, **Mitcham Common 'route B'** (Merton) 1995–2005, **Wildfowl and Wetlands Trust Wetland Centre at Barn Elms** (Richmond upon Thames) 1996–2005, **Railway Fields** (Haringey) 1997–2005, **Cranford Park** (Hounslow) 1997–2005, **South Norwood Country Park** (Croydon/Bromley) 1998–2005, **Trent Country Park** (Enfield) 1998–2005, **Tower Hamlets Cemetery Park** (Tower Hamlets) 1999–2005, **Gunnersbury Triangle** (Hounslow) 1999–2005, **Roxborough Rough** (Harrow) 1999, 2001–2005, **Brent Reservoir** (Barnet/Brent) 2000–2005, and **Regent's Canal towpath from Mile End Road to Mare Street** (Tower Hamlets/Hackney) 2001–2005.

Hutchinson's Bank Nature Reserve (Croydon) was walked in 2005 but at the time of writing, data was complete for some of the early season species only and these have been included in the indices as appropriate. The Featherbed Lane Roadside Verge/The Gallops (Croydon) transect was not walked in 2005 as the transect route had not been cut and was overgrown with vegetation. A new transect was established at Kenwood (Camden) and should contribute to the index from the second year of data. Transect data for 2005 was also received from Farthing Downs New Hill and Riddlesdown Quarry. An update on the transect at Abney Park Cemetery (Hackney); and data from transects at Horsenden Hill East, Horsenden Hill West and Perivale Wood (all in Ealing) are provided in Murray and Wood (2006). Records from these transects and from other observations by LNHS observers have been included in the species accounts where appropriate. Records also contribute towards the county and national databases maintained by Butterfly Conservation.

Results

The species accounts below are based on the collated indices. Indices for 1995 to 2005 are presented in Table 1. The order and nomenclature follow Asher et al. (2001).

Small skipper *Thymelicus sylvestris* and Essex skipper *Thymelicus lineola*

Small and the Essex skippers are species of rough grassland habitats; and are often counted together by transect walkers due to the difficulty of separating these species in flight. Small and / or Essex skippers were recorded on most transects. A high count of small skippers at Trent Country Park was attributed by Robert Callf to the absence of cutting of some grasslands for three years (though those grasslands were cut in 2005). The Trent Country Park count

contributed approximately a third of the London total. At six transects, attempts were made to identify a sample of the two species separately; and overall, small skippers appeared to be more common than Essex skippers, particularly at Trent Country Park. Essex skippers were more common at Tower Hamlets Cemetery Park. Total count on transects: 2,054.

LARGE SKIPPER *Ochlodes sylvanus*

Large skippers prefer grassland habitat with a higher proportion of shrubs than small and Essex skippers. The species was widely distributed in London, though there were variations in numbers at individual sites. Total count on transects: 443.

DINGY SKIPPER *Erynnis tages*

In 2005 data was available from only one of the three transects where the dingy skipper was recorded during recent years. A further nine dingy skippers were recorded at Riddlesdown Quarry. Total count on transects: 42.

GRIZZLED SKIPPER *Pyrgus malvae*

Though the numbers and index were lower than in 2004, the index was based on data from only one of the three transects were the grizzled skipper was recorded during recent years. From just outside of Greater London but within the LNHS recording area, a grizzled skipper was observed by Stephen Spooner at Walton Reservoir / Lambeth Basin on 3 and 12 June 2005. Total count on transects: 5.

BRIMSTONE *Gonepteryx rhamni*

Brimstones were recorded at all but three transects. The index was the highest since 1992, albeit data was not available from the two transects that had the highest counts in 2004. Three north London sites, Hampstead Heath, Beane Hill and Tower Hamlets Cemetery Park, had their highest counts since their transects commenced. Species action plans, formal (e.g. Environment Trust 2004) or otherwise, for the brimstone have been established to cover parts of the swathe of north London where the brimstone was largely absent in the 1980s (see Plant 1987). Planting of larval foodplants, which include alder buckthorn *Frangula alnus* and buckthorn *Rhamnus cathartica*, has now been undertaken at Tower Hamlets Cemetery Park, elsewhere in Tower Hamlets, at Railway Fields, Fryent Country Park, Beane Hill, elsewhere in Brent, and by early 2006 at Kew Gardens and locations in Harrow and in Barnet. In 2005, brimstones were also recorded at the Kenwood Estate, Cannon Hill Common and Bushy Meads, Alexandra Park, Haringey, Palace Gates Road at Wood Green, Tottenham, Roe Green Walled Garden in Brent, Christchurch Avenue in Harrow; and from other sites in London and the wider LNHS recording area. Total count on transects: 423.

LARGE WHITE *Pieris brassicae*

A high count at Tower Hamlets Cemetery Park contributed to an increased index compared with the previous two years. Total count on transects: 979.

SMALL WHITE *Pieris rapae*

Widely distributed in London, numbers appeared to be higher at green spaces in urban London rather than at sites in the green belt areas. Total count on transects: 2,211.

GREEN-VEINED WHITE *Pieris napi*

The index declined compared with 2004. Total count on transects: 1,005.

TABLE 1. Collated indices for butterfly species in London, 1995–2005. Indices have been rounded to the nearest whole number and have usually been set at 100 in 1990 or the first year of record, though indices may be set at 100 in other years or at a different figure where this aids interpretation. A blank indicates no transect records for that species in that year. A zero implies that that species was not observed on transects in that year. A question mark indicates that a species was present in that year, but that there was insufficient data to calculate and index. See the text for further information.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Small and Essex skippers	113	174	166	95	102	85	100	77	82	86	99
Large skipper	146	73	64	43	63	59	43	75	105	71	81
Dingy skipper	?	?	100	58	51	63	33	46	121	80	53
Grizzled skipper	?	?	100	25	63	27	16	47	41	82	21
Clouded yellow	0	100	0	109	0	2,255	0	62	114	118	0
Brimstone	124	104	92	82	79	125	95	95	83	122	136
Large white	137	46	143	278	123	129	111	175	119	146	175
Small white	244	109	316	163	92	136	120	151	173	255	210
Green-veined white	147	58	140	188	95	101	65	104	81	104	68
Orange tip	73	36	80	66	50	80	66	81	45	68	87
Green hairstreak	91	45	72	36	18	16	63	42	53	66	42
Purple hairstreak	123	77	248	416	377	394	266	429	271	398	711
White-letter hairstreak	40	109	72	33	14	13	30	17	21	14	75
Small copper	67	68	72	61	46	25	6	4	68	61	24
Small blue	?	?	100	225	175	188	338	0	38	25	25
Brown argus	98	80	96	10	11	19	7	7	44	40	15
Common blue	144	59	79	40	78	64	39	39	129	60	58
Chalkhill blue	109	109	288	75	180	90	80	41	41	93	29
Holly blue	83	98	20	65	38	44	53	41	43	63	73
White admiral				100	0	0	0	0	0	100	0
Purple emperor											100
Red admiral	304	209	101	137	128	262	193	206	419	133	164
Painted lady	11	744	12	8	12	70	9	83	430	44	4
Small tortoiseshell	305	121	305	184	152	72	42	25	66	143	48
Peacock	568	790	781	1,120	1,108	1,497	1,067	647	398	595	571
Comma	143	106	127	133	118	206	154	136	207	149	121
Dark green fritillary			100	148	181	63	7	11	91	9	?
Silver-washed fritillary					100	300	100	0	0	0	?
Speckled wood	151	73	122	144	165	178	150	208	233	143	152
Wall brown	1	0	0	0	0	0	0	0	0	0	0
Marbled white		?	100	61	54	38	14	18	36	26	24
Gatekeeper	117	138	138	107	157	173	151	143	185	237	320
Meadow brown	105	136	117	165	155	152	96	70	144	116	168
Ringlet	193	64	221	291	346	474	240	290	396	218	236
Small heath	6	21	23	17	3	2	1	1	9	7	10

ORANGE TIP *Anthocharis cardamines*

The index was the highest since 1993. Orange tips have a preference for sites with damp grasslands. Total count on transects: 324.

GREEN HAIRSTREAK *Callophrys rubi*

Data was available in 2005 only from one of the three transects where the green hairstreak had been recorded in recent years. Other records from the southern edge of London were at Riddlesdown Quarry and Farthing Downs New Hill; and away from the transects, at five different locations at Mitcham Common. Total count on transects: 7.

PURPLE HAIRSTREAK *Neozephyrus quercus*

The index for the purple hairstreak was the highest since the London indices for this species commenced in 1990. There were particularly high counts at Mitcham Common route A and at the Brent Reservoir, and purple hairstreaks were also recorded at four of the other transects. Purple hairstreaks generally fly in the evening and therefore were probably more frequent than suggested by the daytime transects. It is probably widespread throughout London and is associated with oak trees and woodland with oak. Other records were from Kenwood with a count of 25, from Alexandra Park and Horsenden Hill. Total count on transects: 74.

WHITE-LETTER HAIRSTREAK *Satyrium w-album*

The index for the white-letter hairstreak was the highest since 1996, though the species was recorded on only two transects, with 9 on the Trent Country Park transect and one at Mitcham Common route B. Away from the transects there were further records from Mitcham Common; and records from Cannon Hill Common / Bushy Meads, in the vicinity of Trent Park and Park Farm at Enfield, and at Horsenden Hill. In the LNHS recording area beyond Greater London the species was present at Watham Abbey. Total count on transects: 10.

SMALL COPPER *Lycaena phlaeas*

The index was lower than in 2003–2004, but higher than the low indices of 2001–2002. The highest counts were at transects on sites with relatively large areas of semi-natural grasslands. There were other records from Alexandra Park and elsewhere. Total count on transects: 154.

SMALL BLUE *Cupido minimus*

Two small blues were recorded on the transect at Hutchinson's Bank Nature Reserve, as in 2004. Ten were recorded on the partial transects at Riddlesdown Quarry. Total count on transects: 2.

BROWN ARGUS *Aricia agestis*

The brown argus was recorded on five transects, including Mitcham Common and South Norwood Country Park, though data for 2005 was unavailable from some of the sites on the southern edge of London where it was recorded in recent years. Other records were from Arkley, Barnet; and from Vicarage Farm and Parkside Farm in Enfield. From just outside of Greater London but within the LNHS recording area, the brown argus was present at Walton Reservoir. Total count on transects: 7.

COMMON BLUE *Polyommatus icarus*

The common blue was widely distributed throughout London, though numbers can vary considerably at individual sites from year to year. Total count on transects: 458.

CHALKHILL BLUE *Polyommatus coridon*

The chalkhill blue is a species of chalk downland and was recorded on two transects on the southern edge of London. The index fluctuates considerably from year to year and in 2005 it was the lowest since 1993. The species was also recorded at Riddesdown Quarry. Total count on transects: 20.

HOLLY BLUE *Celastrina argiolus*

Recorded on most transects, the index was the highest since 1996. The highest count was again at Tower Hamlets Cemetery Park. Total count on transects: 505.

WHITE ADMIRAL *Limenitis camilla*

Though there were no records on the transects, singletons were recorded on five dates in June and July 2005 at Wimbledon Common. In the LNHS area beyond Greater London there were records from Northaw Great Wood and Cow Heath Wood. Total count on transects: 0.

PURPLE EMPEROR *Apatura iris*

A purple emperor was recorded on a transect in London for the first time at Coulsdon Common and in an area where there are a large number of sallows, the foodplant of the caterpillar. Mike Enfield reported also that at Kenley Common, a male purple emperor flew into the conservatory of the Keeper's Cottage, as one had done a few years previously. Beyond Greater London but within the wider LNHS recording area, purple emperors were recorded in the Broxbourne Wood area (as reported by Liz Goodyear and Andrew Middleton in the Hertfordshire and Middlesex Butterfly Conservation Branch *Newsletter*, September 2005: 11–13). Total count on transects: 1.

RED ADMIRAL *Vanessa atalanta*

Most transects recorded the red admiral in 2005. Total count on transects: 140.

PAINTED LADY *Vanessa cardui*

Singletons were recorded on three transects and the index was approximately a tenth of that in 2004, the lowest since 1993 and far below that of the years of large migrations. One was recorded on the route of, but not during a transect, at Trent Country Park. Total count on transects: 3.

SMALL TORTOISESHELL *Aglais urticae*

The index was approximately a third of that of 2004, reversing a modest recovery for this species in London. Zero counts were reported from two transects. Total count on transects: 160.

PEACOCK *Inachis io*

The index was similar to that for 2004. Total count on transects: 511.

COMMA *Polygonia c-album*

Recorded on most of the transect sites in London, the comma is particularly a species of open woodland and woodland edges, such as at Tower Hamlets Cemetery Park. Total count on transects: 319.

DARK GREEN FRITILLARY *Argynnis aglaja*

Though one was recorded at Hutchinson's Bank Nature Reserve, the transect data was incomplete for the remainder of the year and with no records from other transects, it was not possible to calculate an index for the year. Total count on transects: 0.

SILVER-WASHED FRITILLARY *Argynnis paphia*

Similarly, though one was recorded at Hutchinson's Bank Nature Reserve, the transect data was incomplete for the remainder of the year and with no records from other transects, it was not possible to calculate an index for the year. Total count on transects: 0.

SPECKLED WOOD *Pararge aegeria*

The index was similar to that of 2004 for this species of woodland and woodland edges, in both urban and other areas. Total count on transects: 2,100.

MARBLED WHITE *Melanargia galathea*

Data was unavailable from the chalk downland sites that have provided the highest counts during recent years and so data was available from just three transects: the Brent Reservoir with a count of 24 and one each at Roxborough Rough and Riddlesdown. One was recorded on the transect route, but not during a transect, at Trent Country Park. Other records were from Wimbledon Common and Horsenden Hill. Total count on transects: 26.

GATEKEEPER *Pyronia tithonus*

The index for the hedge brown was the highest since transect monitoring commenced in London in 1978; and followed the then highest indices in 2004 and 2003. Much of the increase, and some of the highest counts, were at transects on sites within urban London. At some of these sites, counts had increased from low numbers or even zero within the last ten to fifteen years. Other records were at Tottenham, Alexandra Park and Palmers Green. A distribution map of the gatekeeper in the LNHS area which clearly showed the increase in the distribution within the Greater London part of the area between 1980–6 and 1995–2000 (Fox and Williams 2006), probably underestimates the increase in distribution since 2000. Total count on transects: 4,019.

MEADOW BROWN *Maniola jurtina*

Recorded on all but one transect, the index was the highest since 1991, albeit though the index in 1998 was marginally lower than in 2005. The highest count (3,113) was at Kenley Common where numbers increased considerably on those of 2004. The counts at Kenley Common and at Coulsdon were the highest for those sites since monitoring commenced in 1990. Total count on transects: 12,037.

RINGLET *Aphantopus hyperantus*

The ringlet was frequent on some sites at the southern edge of London, and also present at Trent Country Park, while away from the transects there were records at Mitcham Common and one at Railway Fields. Within the LNHS area beyond Greater London there were records from Northaw Great Wood, Brickendon Green, Broxbourne Wood, Cowheath Wood, and the ringlet was probably present at a large number of other locations. Total count on transects: 310.

SMALL HEATH *Coenonympha pamphilus*

The large majority of records were at Trent Country Park, with much of the remainder at Cranford Park and Farthing Downs. There were small numbers at three green spaces within urban London. A count of two on the Mitcham Common route A transect and from elsewhere at Mitcham Common followed several years without any records of the small heath at this site. The overall

distribution pattern and the index was similar to that for 2003–4, following the slight recovery from the lows of 1999–2002, and contrasting with the early 1990s when the small heath was widely distributed and relatively common in London. Total count on transects: 1,245.

For details of species that were recorded beyond Greater London but within the wider LNHS Recording Area, reference should be made to the respective county reports produced by Butterfly Conservation and other organizations, e.g. Murray and Wood (2006). The following 2005 records were received of species recorded in the wider LNHS recording area but not from within Greater London:

BROWN HAIRSTREAK *Thecla betulae*. The *Newsletter* of the LNHS (No. 193, December 2005) reported the finding by Roger Booth and Ian Menzies of eggs of the brown hairstreak at Bookham Common in January 2005; and of the adult in July 2005.

SILVER-STUDDED BLUE *Plebeius argus*. Small numbers were present, as in 2004, at a site at Fairmile Common.

Discussion

Increases in the distribution and abundances of the brimstone and gatekeeper butterflies in urban areas in London have been noted in the species accounts above. In the case of the brimstone the increases have been encouraged by the planting of the larval foodplants in public open spaces and in private gardens; and this work is continuing. Possible reasons for the increase in the distribution of the gatekeeper and of changes in the distribution of other species in the LNHS London Area were the subject of comment by Fox and Williams (2006), a study which compared distributions based on the LNHS butterfly atlas project of 1980–6 (Plant 1987) and of the Butterflies for the New Millennium project organized by Butterfly Conservation in 1995–2000 (see Asher et al. 2001). The distribution of the brown argus increased, particularly in the wider LNHS area beyond London but also within the south-west and south-east of Greater London. However, the indices indicate that the abundance of this species appears to have declined in Greater London, at least between 1990 and 2005. For most other species subject to marked changes in distribution in the LNHS area between 1980–1986 and 1995–2000, there were corresponding changes in the abundance over approximately the same periods. Examples include the increase in the distribution of the speckled wood particularly north of the Thames; the decline of the wall brown from areas in the south of the LNHS area and then from the north of the area; and the reduced distribution of the small heath. Between 1980 and 1986 and 1995 and 2000, there were increases in the distribution of the purple hairstreak, white-letter hairstreak, holly blue, marbled white and ringlet; and marked changes in the distribution of a number of 'habitat specialist' butterflies (Asher et al. 2001) albeit generally within the restricted geographic area of their habitat requirements.

Acknowledgements

In 2005 the transect walkers were Richard Payne and Adrian Brooker at Hampstead Heath, Michael Berthoud, Simon Mercer and Leslie Williams at Fryent Country Park and Beane Hill, Ann Rix at Gutteridge Wood, at the Corporation of London sites on the southern edge of London (Coulsdon, Farthing Downs, Kenley Common, Riddlesdown, Riddlesdown Quarry, and Farthing Downs New Hill) the team comprised Mike Enfield and colleagues; Diane Furley and Lorna Arnold at New Barnet Allotments, Martin Boyle at Mitcham Common, R.J. Bullock at WWT Wetland Centre at Barn Elms, David Bevan and Keir Mottram at Railway Fields, John Grayley at Cranford Park, Martin Wills at Hutchinson's Bank Nature Reserve, Malcolm Bridge at South Norwood Country

Park, Robert Callf at Trent Country Park, Terry Lyle, K. Greenway and A. McGuire at Tower Hamlets Cemetery Park, Nicola Thompson, Kathy Hall and A. Brown at Gunnersbury Triangle, Paul Jeffery at Roxborough Rough, Andrew Self and Roy Beddard at the Brent Reservoir, Donald Rooum at Regent's Canal towpath, and Mike Taylor at Kenwood. Records were also received from some of the transect walkers listed above and from, Diane Andrews, Roger Booth, Gay Carr, Richard Donovan, Bob Gillam, David Howdon, Ron Kettle, Ann Lawrence, Joan Lowe, Mick Massie, Ian Menzies, Paul Sellers, Stephen J. Spooner, Dave Wills, Nigel Willets, Alan Wingrove, and from London Natural History Society field meetings / LNHS *Newsletter*, and the Butterfly Conservation Hertfordshire and Middlesex Branch *Newsletter*. Landowners and land managers of the sites have an important role in undertaking habitat management and supporting monitoring. These include a significant number of the London boroughs (see the Methods), the Corporation of London, other public authorities, the London Wildlife Trust, the Mitcham Common Conservators, the Friends of Tower Hamlets Cemetery Park, Barn Hill Conservation Group and the Welsh Harp Conservation Group. The co-operation with the county co-ordinators for Butterfly Conservation is noted, particularly Mike Enfield (Surrey), and John Murray and Andrew Wood (Hertfordshire and Middlesex). Dr Dave Dawson advised on the statistical method for the collations and the programming of the spreadsheets. Simon Mercer helped develop the series of linked spreadsheets. I also thank Colin Plant, Richard Fox, the Greater London Authority, the Millennium Awards, British Trust for Conservation Volunteers, and Caroline Williams.

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Book review

The Wisdom of God Manifested in the Work of the Creation. John Ray. Facsimile of the 1826 edition. The Ray Society, London. 2005. xxiv, 331 pp. £30 from booksellers. ISBN 0 903874 32 6.

John Ray (1627–1705), arguably the most influential English naturalist of all time, chose to write this, his most popular book, first published in 1691, in English, not Latin, to give it a wide readership. In it he moved on from the naming and cataloguing of plants and animals to consider their lives and how nature worked. He also discussed geology and cosmology, combining his science with his deep religious faith, attempting to reconcile the two through what he termed physico-theology.

It is a book of its time, and not just in his account of biology and theology. The phraseology and atmosphere of the book breathe the seventeenth century in a most charming way. It is also a book for the future. William Derham, William Paley and others propagated his physico-theology for a century and a half, and naturalists like Gilbert White, inspired by 'our countryman, the excellent Mr Ray', furthered the British tradition of natural history. Even Charles Darwin's work, although it refutes Ray's views on evolution and the role of God, is, in many ways, a true development of the combined programme of natural history and philosophy which Ray initiated in *The Wisdom of God.*

This facsimile of the full 1826 edition is complemented by an essay, available with the facsimile, by the late Dr Max Walters, reappraising the relationship between Ray and Linnaeus and contrasting, starting with Ray, the development of botanical systematics with zoological systematics.

The Ray Society, instituted in 1844, has a distinguished history of publishing learned books on natural history, with special but not exclusive reference to the British flora and fauna, which might not otherwise be published. *The Wisdom of God* is No. 167 of the series. Among titles in preparation are *Bees of the British Isles, Click beetles, British Desmidiaceae* and *Linnaeus' zoology.* The Ray Society is open to any person willing by subscription (currently £6 per annum) to promote its work. Members are entitled to purchase one copy of each new volume at a concessionary price and may also purchase earlier works at a discount. Details of membership may be obtained by writing to The Honorary Secretary, The Ray Society, c/o Natural History Museum, London SW7 5BD.

K. H. Hyatt

Survey of Bookham Common

SIXTY-FOURTH YEAR

Progress Report for 2005

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General (Ian Menzies, Chairman, Bookham Common Survey)

Reports for 2005 at Bookham cover a wide range of subjects. Besides the usual coverage (management, vegetation, birds, mammals, dragonflies, grasshoppers and bush-crickets, beetles, butterflies and moths), a paper by Andrew Halstead updating the sawflies of the Common is also included.

Perhaps the most interesting findings for 2005 include that of the brown hairstreak butterfly, which has recently become an established breeding species on the Common, also of colonies of lesser marsh and rufous grasshoppers (the former new to Bookham), and the possible return of the short-winged cone-head bush-cricket. Alison Fure has successfully detected the dormouse on Bookham Common using a 'nesting-box technique' — another positive achievement. Steve Mellor, who now leads the Botanist Group in place of Ken Page, reports that National Trust management is having a positive impact. Steve's leadership comes as a timely relief to Ken Page and Bryan Radcliffe, our most senior botanists, who can now attend in a more relaxed state!

As explained in the bird report, Alan Prowse has recently switched his main focus to woodland: in this he is probably following the birds back into the now 'not-so-dense' woodland — in its way an indication of the success of the recent woodland thinning policy of National Trust management, described by Ian Swinney in his management report. Recently NT 'Management tasks' have largely concerned the retrieval of open grassland on the plains by scrub removal, and the thinning of dense woodland, widening of rides and glades, and removal of brush at pond margins, all of which encourage the growth of ground vegetation and associated species by promoting greater access to sunlight.

The advantages of a larger hut, officially opened on 9 October 2004, have become even more obvious during 2005, and members of the LNHS Bookham Common Survey are grateful to all those who contributed to the Ruth Day Fund and helped in other ways to acquire this pleasant retreat. For many years now the botanists have contributed the largest and most visible group attending our 'Second Saturday' monthly meetings. A smaller group of invertebrate enthusiasts also attend regularly, appreciating the availability of botanical expertise. Although strong ornithology and mammal study groups are also following regular projects, they tend to visit at other times and in smaller numbers, probably for fear of frightening off the objects of their study. After more than sixty years it can be said the LNHS Bookham Survey now has a good idea of the range of wildlife species present. It would now be logical to focus more on ecology, to define and understand factors that provide a sound basis for management.

Management tasks on the Bookham Commons, 2005

(Ian Swinney, National Trust warden for the Bookham Commons SSSI)

General. For much of 2005 I was involved with the handover and temporary secondment following the retirement of John Cranham, Head Warden for the National Trust North Downs West Properties (large areas of nationally important chalk downland, farms and parkland including Bookham Commons). So, from caring for 450 acres (200 hectares), I was suddenly working with a team of six wardens, ten Exmoor ponies, Soay and Herdwick sheep, eighty Boer goats, and forty Dexter cattle in an area of nearly 4,000 acres!! So you can imagine I was fairly busy at this time . . . . However, with the excellent support of the wardens we were able to undertake some useful tasks. Thankfully I am now back at Bookham, and though working on these other sites for some of the time, I can devote more of my attention to the Commons.

Grassland and scrub. Limited, carefully cleared areas have been created on Central and Bayfield Plains by removing some over-mature scrub, thus encouraging the grassland seed bank to initiate recolonization by ground vegetation and young dense thorn as a future refuge for invertebrates and nesting birds. This work is essential to prevent the grassland rapidly reverting to oak woodland which we already have in relative abundance.

Whilst there is a need to allow scrub to develop, as most nesting birds favour dense five to fifteen year old scrub, it is also necessary to avoid loss of open species-rich, unimproved pasture. As always, each habitat needs to be of sufficient scale to sustain populations, making due allowance for natural fluctuations. Population size can be critical for long-term survival of plant and animal species, and there need to be sufficient numbers left to enable recovery following a bad season, small colonies may also inbreed to their disadvantage or extinction for genetic reasons. Therefore the size of each habitat becomes important when considering management options.

Much of the Common that used to be open grassland has now become oak woodland with an understorey of thorn scrub, evidence of former grazing. In preserving valuable grassland, which would otherwise disappear under scrub, we need to be thinking thirty or forty years ahead, clearing along the woodland edges and devising an effective rotational management for scrub which is an important environment in its own right. Should we get the resources to introduce such a long-term plan, grazing will remain necessary, at least for a while, otherwise the thorn scrub will be replaced with a forest of birch and sallow, less favourable for nesting birds and subject to rapid conversion to dense woodland.

Oak woodland. The use of woodland has changed significantly in the past hundred years. Before 1890, if you required a source of energy to keep warm you would have to take a horse and cart to Leatherhead for coal, or make do with the local firewood, which would have to be cut from the Commons. Very little waste was burned on site, even the branches being bundled into faggots for the bakery ovens! On the arrival of the railway, it wasn't long before a big coal yard was established next to the station, lessening the demand for wood.

At that time the Commons were a source of fuel and of oak timber for building. This was followed up by grazing with domestic animals, thinning significant areas of the lower slopes to produce wood pasture. The evidence is there — at intervals there are the large broad-crowned veteran oaks that developed on quite open ground, in addition to an understorey dominated by thorn, evidence of past grazing.

The older open-grown oaks, often hollow with well-developed lateral branches containing large amounts of dead wood, have acquired a richer ecology than the younger, densely packed, straight trees have, including

specialized ancient woodland species. The older oaks are also a very special, desirable feature of the landscape. Access of more light to the woodland floor, a result of tree thinning, also encourages a greater diversity of ground flora (if grazing is not too severe) and will provide a richer fauna.

Tree thinning of some woodland areas is therefore proposed until more extensive seasonal grazing becomes possible. Before implementing tree thinning (a technique known as 'halo release') on a wider scale, it is proposed to undertake a survey of veteran trees so that the effects of removing the younger ones largely responsible for crowding and shading can be effectively monitored. This needs to be continued for a period of fifteen to twenty years to minimize the effects of increased exposure to light and wind. Similar work has already commenced at Ashtead Common and Hatfield Forest.

It is also important to identify suitable younger trees that can be allowed to grow free of competition and provide a broad age-range of well-shaped trees as eventual replacements — a minor matter requiring anticipation on a scale of some 400 years!

On the 1947 aerial photograph of the Commons, the track known as the Broadway is clearly visible, though so overgrown that this was something of a misnomer. A Christmas gathering of all the National Trust wardens and volunteers for the North Downs, plus staff from the Hatchlands and Clandon properties, soon restored its former width (in a matter of two days!). We are grateful to all who took part, as will be the white admirals and silver-washed fritillaries.

Ponds and wetlands. A small amount of clearing was undertaken to allow more light to reach the margins of Lower Eastern Pond. Recently, similar work at Bayfield Pond has yielded good results with a fine show of water crowfoot in summer 2005.

The wetland area between Lower Eastern and East Hollows Pond has recolonized with a good range of marsh plants following clearance by volunteers and staff the year before, and again presents a warm, sheltered and sunny haven for invertebrates.

A proposal for major clearance of the overwhelming growth of reed mace *Typha latifolia* on Lower Eastern Pond is being currently prepared. This will need to be undertaken carefully to preserve what remains of the greater skullcap *Scutellaria galericulata* inhabited by the notable leaf-beetle *Phyllobrotica quadrimaculata*. Much consultation has taken place with the London Natural History Society, English Nature, The Environment Agency and National Trust Conservation Advisers. Wet woodland is a UK BAP habitat and the retention of some of the goat willow carr is important, though there is also a shortage of open wetland areas.

In conclusion I would again like to express the appreciation and gratitude of The National Trust to the London Natural History Society and members of the Bookham Commons Survey in particular, for highlighting the amazing range of wildlife that can still be found here and thereby helping us greatly with the management of this very special place.

Vegetation (Steve Mellor)

Bookham Common has continued to surprise and delight us botanically during the past year. There are strong indications that recent management practice, particularly scrub and wood clearance and stock grazing on the plains of Divisions P, Q and R has resulted in increased diversity and range of plant species found across these areas. Spring-flowering plants in particular have benefited from the greatly increased areas of short sward resulting from the previous years' grazing. The genera *Myosotis* (forget-me-nots) and *Veronica* (speedwells) were particularly plentiful.

It is significant that we refound a number of species in Divisions P, Q and R where they had not been recorded since the first botanical survey more than fifty years ago. Examples are *Lathyrus nissolia* grass vetchling and *Alisma plantago-aquatica* water-plantain in cleared areas near Bookham Stream at opposite ends of Division P, *Eleocharis palustris* common spike-rush in Division Q and *Galium mollugo* hedge bedstraw in Division R. The last two species were not recorded anywhere on the Common in the second and third surveys. It would be highly fortuitous for species to return from outside the Common to the very same division they occupied previously. More probably they remained in the seedbank or as hidden vegetative plants until growing conditions improved.

It is clear that opening up the plains and the reintoduction of grazing has been a success from the standpoint of botanical diversity, and this must reflect on the general ecological health of the Common. Let us hope that other plant species that have been lost from the record will also reappear when they see the light.

In contrast, some late-flowering plants fared badly; a particular casualty has been *Silaum silaus* pepper-saxifrage that was not recorded anywhere on the Common in 2005 and in particular on the grazed plains areas that previously had been its stronghold. *S. silaus* is an attractive yellow-flowered umbellifer that is usually found on wet or damp grassland on clay, and has been decreasing nationally for some years. It is possible that the recent warmer and drier climate has contributed to the decline, though grazing at Bookham appears also to have been a factor.

Rorippa nasturtium-aquaticum agg. watercresses have shown a remarkable increase in recent months along the streams on the Common. There are sparse historical records in Divisions N and P, but we have recorded it recently in Divisions N, P, Q, R and S. Reasons for the change are not clear but increased areas of open water following the recent clearance programmes must be significant. Vegetatively, the pinnate leaves of watercresses can be confused with *Apium nodiflorum* fool's-watercress that is a common waterside herb, and in competition tends to overgrow and shade out the watercresses. *A. nodiflorum* differs in having sheathing petioles (leaf stalks) and markedly hollow stems. In flower/fruit, umbels distinguish it from watercresses which are crucifers with crowded panicles (spikes) of four-petalled white flowers.

There are three taxa in the watercress group: *Rorippa nasturtium-aquaticum* watercress, *Rorippa microphylla* long-fruited or brown watercress and their hybrid *Rorippa* × *sterilis* hybrid watercress. They cannot be identified from vegetative features alone; to do so requires the examination of fruit and seed, but these are not always formed. *R. nasturtium-aquaticum* fruits have many biseriate seeds (i.e. lying in pairs across each identical valve of the pod, so a transverse section shows four seeds) and the seed surface is marked with coarse reticulations. *R. microphylla* tends to a longer, narrower fruit with mainly uniseriate disposition of seeds with much finer surface reticulations. *R.* × *sterilis* fruits are short and distorted with few well-formed seeds that show an intermediate pattern of surface reticulations. Ripe fruits were collected from two populations of watercress recorded in Divisions N and R; each was *R. microphylla*.

We recorded two particularly notable populations of *Rorippa nasturtium-aquaticum* agg. that are worth further comment. In the late autumn of 2004 a number of very robust plants developed when water again flowed in Central Ditch after the dry summer. They scrambled out of the bed of the ditch, climbing to at least 1.5 m on nearby scrub. These plants never flowered, but it is reasonable to speculate that they might be *Rorippa* × *sterilis* showing hybrid vigour. Secondly, *R. microphylla* grew across the new marsh formed by winter flooding from the Isle of Wight Ditch near its entry on to the Common to the south of Division R. Before the cattle grazed it off, this population along with

Ranunculus repens creeping buttercup were the dominant plants over an area at least 15 m across. It is remarkable that *Rorippa nasturtium-aquaticum* agg. had never previously been recorded in Division R.

As is usual, the survey team recorded a number of taxa for the first time on the Common in 2005; these include the aliens that we have come to expect, but also native taxa, and a very interesting hybrid tree.

We have Keith Bosher to thank for noticing a single diminutive flowering stem on the *Thalictrum* sp. that has, since 2002, been known only as a vegetative plant flourishing under brambles and nettles. The diffuse panicles of small, pale yellow flowers with pendent stamens, confirmed it as *Thalictrum minus* lesser meadow-rue. This species is not considered a native in the south-east of England and is surely an escape from nearby gardens or was deposited with garden waste.

Oenothera glazioviana large-flowering evening primrose is an American species that undoubtedly arrived on the Common in dumped garden material; it grew on waste ground near Tunnel car park. This species and other members of the genus are garish, largely yellow-flowered garden plants that can form very persistent colonies when they establish in the countryside, particularly on sandy soils in open habitats.

Medicago arabica spotted medick is a native winter-annual that grew as a diminutive plant on the dry gravelly edge of Banks Path. It has characteristic heart-shaped leaves that are widest distally and have a more or less dark spot in their centre. Its attractive fruits are pods that are tightly wound spirally in several loops and are covered with curved spines (best seen with a magnifying lens). This species has markedly increased its range in recent years, so its occurrence was not unexpected.

Origanum vulgare marjoram, discovered by Ian Menzies, was, however, a most unexpected though welcome find. This native species is characteristic of poor dry chalk soils but it is highly unlikely to have spread naturally from native populations on the Downs; more likely it was transported on machinery used to clear the site where it was found.

Lythrum salicaria purple loosestrife is a native perennial that commonly colours the margins of water bodies with foot-long spikes of purple flowers during the mid to late summer. A single plant flowered near Bookham Stream close to the grazed area and we add this species to the accumulative list even though most of us were sure they had seen this species in earlier years.

Striking creamy-white flowers drew our attention to a small tree with unusual partially pinnate leaves. We believe it to be *Sorbus* × *thuringiaca*, a natural hybrid between the native trees *Sorbus aria* whitebeam and *Sorbus aucuparia* rowan. *S.* × *thuringiaca* will be discussed more fully in a later issue of this journal.

Birds (Alan Prowse)

Breeding season. Little grebes raised young on Isle of Wight and East Hollows Ponds, and adults were recorded on West Hollows Pond though no evidence of successful breeding was seen. An adult female mute swan was present on Isle of Wight Pond in March but was displaced by a pair of Canada geese which raised three young. Mandarin ducks were recorded around the main ponds and the Hundred Pound Bridge area in the breeding season; moorhens nested on the main and outlying ponds while two coot pairs raised young on Isle of Wight Pond.

Grey herons had fourteen successful nests, a smaller number than usual; sparrowhawks raised only one young, a female, in SE Wood, and others were known elsewhere; buzzards were seen often over the Common, but no young were seen here, nor on Chasemore Farm where another pair has been in residence for several years; kestrels were seen occasionally on the Common, again with a known pair at Chasemore Farm. For the first time for some years

red-legged partridges were seen in the woodland, in Stent's Wood as well as nearby farmland, and lapwings nested on the field by Kelsey's Wood.

Stock doves were recorded singing in Kelsey's Wood, as well as usual areas. Collared doves were by the hotel, the station, and the gardens to the south-east. Turtle doves were recorded in Little Bookham, just off the Common, from 8–28 May, displaying on the last date (CP); other records of this species were few and far between, but one was on Bayfield on 28 May, and one crossed Chasemore Farm to Bookham and Banks Commons on 5 July. The first cuckoos were heard on 21 April, and the first female on 4 May. Lesser spotted woodpeckers were known in three areas. Ring-necked parakeets are now in evidence throughout the year, especially in the trees near the car park by Bayfield Plain.

Swallows continue to hunt the Common from Chasemore Farm, but no nests were recorded at Banks Path houses this year, though three house martin pairs nested there. No survey of warbler numbers on the plains was made this year. Five territories of nightingales were known, with none on Central/Bayfield this year. No starlings now nest on the Common, and a small number of house sparrows breed by the allotments, where there is a feeding station. Since the felling of Hundred Pound Bridge Wood several years ago goldfinches have been increasing in this area, and in cleared areas on the plains. Bullfinch numbers have dropped in the cleared areas of the plains, but are still present in the denser scrub. Buntings cling on, with a singing male reed bunting on Bayfield on 7 and 8 May, and a pair of yellowhammers on the border with Chasemore Farm (and a second pair on Chasemore this year).

Scarce woodland bird survey

In 2005 and 2006 the British Trust for Ornithology is conducting surveys in the breeding season on some 1,200 woods in the UK. Two walks have been planned for Bookham Common, each approximately one kilometre. Birds are recorded to a distance of 100 metres from the transect. Three surveys along each walk were made in 2005, and will be repeated in 2006. It will be best if the results are analysed as a whole at the completion of the second year. It should then be possible to assess the value of these relating to our knowledge of Bookham, and determine whether a yearly survey along these lines would be useful as a woodland index.

Woodland Walk 1. This starts at Hundred Pound Bridge, by the partially felled Hundred Pound Wood. It passes along the road between the light woodland of Western Plain and the old oaks of Hill House Wood. After about 150 metres it goes through Hill House Wood. Here the old oaks with a marked holly understorey give way gradually to more open woodland where a sycamore understorey has has been cleared and the canopy opened. The walk then goes to Kelsey's Pond. It passes through more old oak woodland, lighter woodland with hornbeam and very variable ground cover, ending by farmland which is sympathetically managed.

Woodland Walk 2. This starts at Tunnel Car Park. There are many old spreading oaks in the early part of this walk, and other tall oaks with much ivy. The route along Tunnel Path passes South-East Pond, then through light birch woodland on Eastern Plain. A further belt of oak forest leads to Lower Eastern Pond, and a cleared glade between this and East Hollows Pond. From the ponds to the end of the walk at High Point Path is oak forest. At first there is recent widening of the path and then a large glade. After that is oak forest bordering the old CBC area of Eastern Wood. The canopy here is closed, and there are many turkey oaks. There is little of ornithological interest here, and Alison Fure (pers. comm.) has indicated that it is one of the least interesting areas for small mammals. The suggested reduction of turkey oak in this area, opening up the canopy, would be welcome to improve the conservation status.

Birds of the woodland walks. Of the twenty-eight target species, crested tit, pied flycatcher, redstart and siskin are not breeding birds of the Common; willow tit, spotted flycatcher and wood warbler are recorded in occasional years; the willow tit nested regularly in the woodland until 1982, and recorded there in two years subsequently; the wood warbler last nested on the Common in 1996. Lesser redpoll and tree pipit are past breeders; the lesser redpoll has not bred since 1972, and the last singing male tree pipit, on Eastern Plain, was in 1973. Firecrest has been reported as a vagrant only. The hawfinch is thought to be regular in the breeding season, but is elusive. It was recorded in the 2005 survey, in the area where it has been recorded since 1997. Seventeen species occur annually on the Common, in the breeding season, though not all are recorded in the woodland. In the woodland CBC area the nightingale ceased breeding in 1973, the turtle dove in 1976, the willow tit in 1987, the garden warbler in 1989, and the willow warbler in 1990 (apart from one in 1997). The Common Birds Census ceased in 1997, having recorded the woodland birds since 1949. In its last year it suggested densities for some species (in pairs per square kilometre) as follows: green woodpecker 6; great spotted woodpecker 19; dunnock 6; song thrush 6; mistle thrush 6; blackcap 37; goldcrest 6; marsh tit 12; nuthatch 25; treecreeper 12, though studies since in several areas of woodland have found densities to be above 30.

Acknowledgements

I would like to thank Lance Gibbs, Ron Kettle, Colin Pettigrew, Anna Stribley, and Ian Swinney for their help and recording.

Mammals (Alison Fure)

Bat survey, Kelsey's Wood, 10.x.2005. The usual early pipistrelles in the Hundred Pound Bridge car park indicated a nearby roost but our interest was in the bats in the interior of Kelsey's Wood. Two pipistrelle species were found feeding around the perimeter hedge near Kelsey's Pond. There was very little foraging activity in the wood but some interesting bat passes. At the junction of Glade and High Point Paths there was increased activity, including several *Myotis* zizzes (their brief noise on the bat detector). Tawny owls were heard calling during the evening but more worrying the occasional report of a shotgun indicating that the illegal poaching still continues and makes it very difficult to organize evening bat surveys.

On a walk with the rangers to discuss management (27.x.2005) it was confirmed that deer numbers have fallen as larger numbers than usual have been culled. Brambles blocked paths around Hundred Pound Wood so the boxes could not be reached for cleaning and inspection. In accessible areas the usual number of woodmice making winter nests were found (Figure 1). Discarded acorns eaten by both mice and birds were amongst the food remains inside the boxes. Alan Prowse suggested two small holes in an acorn may have been made by the sharp bill of a coal tit.

Winter 2005–2006. Several boxes had been used by bats (thought to be brown long-eared) and droppings were found beneath the hole (Figure 2) on top of nest material introduced by mice, also just beneath the lid. This raises the possibility that bats may have been using the boxes at the same time as the woodmice. It was interesting that no moths (BLE prey species) were found in any of the boxes, unlike last year when practically all of the boxes in Stent's Wood held up to ten moths each. Three boxes held a similar amount of moss (an egg-cup full) of this season's nests and tits were standing over other boxes they had selected for furnishing.

Spring 2006. On a 'box check and clean' (2.iv.2006) the first dormouse nest carefully made of honeysuckle was found (Figure 3): this was in a box that had been inaccessible in October 2005 due to bramble overgrowth. Characteristic

strips of honeysuckle bark were also found in a second box. It commonly takes dormice a couple of years to establish residence following the installation of a box. Whilst disposing of an old moss winter nest from a box close to the Isle of Wight Pond a shrew was found to be in residence. Only one box was found to be occupied, containing three woodmice.

FIGURE 1. Fresh ash leaves for this pair of woodmice in September.

FIGURE 2. Bat droppings on the ledge beneath nest-box entrance hole.

FIGURE 3. Dormouse nest mainly constructed with strips of honeysuckle bark.

Dragonflies and other insects Study Day, 9 July 2005
(Neil Anderson)

The day did not appear to be that of midsummer until well into the afternoon when the mercury finally hit 22°C. Earlier it was decidedly cool and overcast — certainly not conducive to an abundance of flying insects! Marsh tits and bullfinches added some avian interest during the lull.

Most of our initial finds were caught by beating or sweeping the vegetation. Large numbers of speckled bush-cricket *Leptophyes punctatissima* and nymphs of long-winged conehead *Conocephalus discolor* were discovered, with smaller numbers of dark bush cricket *Pholidoptera griseoaptera*. A slender ground-hopper *Tetrix subulata* was observed on the vegetated drying mud by Isle of Wight Pond.

In the cool conditions of the morning butterfly sightings were restricted to the occasional meadow brown, ringlet and green-veined white (*Maniola jurtina, Aphantopus hyperantus* and *Pieris napi*), plus three moth species: common swift, heart and dart, and narrow-bordered five-spot burnet. More butterfly species appeared as the sun shone, highlights being the sighting of about thirty purple hairstreaks *Quercusia quercus*, twenty silver-washed fritillaries *Argynnis paphia* and, at the 'master' tree site in Hill House Wood, three male purple emperors *Apatura iris* putting on a mid-afternoon gladiatorial display in the canopy. Over lunch Ian Menzies passed round a live brown hairstreak butterfly which he had reared from a larva beaten from blackthorn on Central Plain. Introduction of this species, although considered by K. J. Willmott unlikely to succeed, was attempted in 1986, the only subsequent sighting being of a worn male on 1.ix.1990 (Menzies 1991). A natural colonization by this elusive butterfly, indicated by the discovery of quite large numbers of the ova on blackthorn during the winters of 2004–5 and 2005–6, is excellent news (see accompanying Lepidoptera report).

Amongst Odonata, a male emperor *Anax imperator* perched in a woodland glade provided some photographic opportunities of this powerful flier. Two patrolling males were also noted on Isle of Wight Pond which also supported territorial male and a copulating pair of broad-bodied chasers, a pair of banded demoiselles and numerous common blue damselflies.

In the marshy area at the rear of Isle of Wight Pond a couple of nymphs (with bright red abdomen) of the blue shield bug *Zicrona caerulea* were found — this species is carnivorous, predating chrysomelid larvae. In this instance the following Chrysomelidae (leaf beetles) *Chrysolina herbacea* (= *menthastri*) and *C. polita* on water mint, *Gastrophysa viridula* on dock and sorrel, *Lochmaea capraea* on sallow and *Phyllobrotica quadrimaculata* on skull-cap, were all available. The tiny bluish flea beetle *Aphthona non-striata*, was examined on yellow flag.

Other records included a single hornet and the crab spider *Misumena vatia*.

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Butterflies and moths: field notes for 2005 (Ian Menzies)

8.i.2005: following a message conveyed from Gail Jeffcoate about the appearance of the brown hairstreak butterfly *Thecla betulae* (Linn.) on Bookham Common, Roger Booth and I managed to confirm its presence by finding about twenty eggs distributed on the twigs of small blackthorn bushes in the Bayfield Plain area. More were subsequently discovered by searching on 10.ii.2005 – 12 ova, 12.ii.2005 – 10 ova, 12.iii.2005 – 2 ova, mainly from the blackthorns on Bayfield, Central and IoW Plain and, with lower frequency, from Western Plain and in the vicinity of Merritt's Cottage. The brown hairstreak is generally considered rather an elusive insect, spending long

periods crawling about vegetation rather than in flight. For this reason searching for the eggs during the winter, or beating for larvae during early summer (May and June), are the favoured methods of detection.

12.ii.2005: a finding related to the search for *T. betulae* ova was that of the hibernating larva of the lappet moth *Gastropacha quercifolia* (Linn.) on the Bayfield Plain. This most inconspicuous 2-cm-long larva, together with three brown hairstreak eggs, were found by Mavis Pilbeam and myself on the twigs of a 1-metre blackthorn sapling. The lappet plus twig was removed and bred through successfully. It commenced to feed on the leaves of cherryplum as soon as these appeared in my garden, growing larger and yet larger — finally reaching the astonishing length of 10.5 cm two instars later, and then weaving a floppy cocoon amongst the leaves. A splendid moth finally emerged on 18.v.2005. Formerly widespread and often common in the London area — larvae being a regular find on blackthorn hedges — the lappet has unfortunately declined since the 1950s to become an extremely local and rare resident (Plant 1993: 16).

11.iv and 11.v.2005: spring butterflies: orange tip, green-veined white, brimstone, speckled wood and peacock were observed on these sunny days, but not the small tortoiseshell which has become noticeably scarce.

25.v.2005: Central Plain: a single brown argus *Aricia agestis*, 6 brimstones — mainly females, 8 orange tips, 8 green-veined whites and, at last, a single small tortoiseshell were noted.

27.v.2005: a single rather worn grizzled skipper butterfly *Pyrgus malvae*, also a single burnet companion moth *Euclidia glyphica* were seen flying in the sun on Central Plain. Two very worn speckled woods, 6 orange tips, 3 green-veined whites and a single peacock butterfly were also noted.

7.vi.2005: a fully-grown brown hairstreak larva was beaten from blackthorn at west side of Central Plain.

21.vi.2005: several very fresh speckled woods were seen, presumably of the second generation. Two freshly emerged silver-washed fritillaries, being the first of many, 10 white admirals and a single small heath, now a rather scarce species, were sighted.

7.vii.2005: my brown hairstreak has finally emerged. The adult butterfly, which has a reputation for being elusive, was searched for during July and August without success despite the discovery of two recently deposited eggs on 21.viii.2005. Although well established in the Weald south of Dorking the brown hairstreak has not previously been known to breed regularly in Surrey north of the Reigate–Guildford escarpment. An attempt to introduce this species at Bookham in the egg stage was made during the winter of 1985–6, but although a worn male was subsequently observed on 1.ix.1990 (Menzies 1991), neither eggs nor larvae of the brown hairstreak could be found during the 1991–2003 period, so that the final outcome of this introduction must be considered uncertain.

9.vii.2005: butterflies observed at the dragonfly field meeting included silver-washed fritillary (20 to 30 being sighted), white admiral (equally plentiful), purple emperor (3 observed), large skipper and meadow brown both plentiful, ringlet very fresh, small skipper and hedge brown just starting to emerge. The purple hairstreak was abundant and many were seen flying low, settling on bracken etc.

12.vii.2005: 10.40–12.30: 8 white admirals and 31 silver-washed fritillaries sighted, one red admiral, two holly blues, but none of the purple emperors

Apatura iris were seen over the Hill House oaks at this time. An emperor dragonfly *Anax imperator* was observed devouring a purple hairstreak butterfly!

13.vii.2005: 14.00–15.00: 10 white admirals and 25 silver-washed fritillaries were counted and at least four purple emperors seen disporting over the group of Hill House Wood master oaks and giant hornbeam (TQ124568, on north side of High Point Path), several were observed immediately on my arrival at 14.30, and then again 30–40 minutes later. It seems that the males do not start their rivalry over the tall trees until well after midday.

28.vii.2005: 14 silver-washed fritillaries, and singles of white admiral, red admiral, comma and peacock butterfly seen.

8.viii.2005: 6 worn silver-washed fritillaries seen — about the last of this year's emergence.

21.viii.2005: a single small copper *Lycaena phlaeas* seen on Central Plain.

30.viii.2005: a rather worn second-generation brown argus *Aricia agestis* observed on Central Plain near Central Ditch.

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Grasshoppers and bush-crickets: field notes for 2005 (Ian Menzies)

28.vii.2005: only about 25 per cent of the long-winged conehead bush-cricket *Conocephalus discolor* were estimated to have reached maturity.

30.vii.2005: a single male dusky cockroach *Ectobius lapponicus* was beaten from a small sallow, Bayfield plain. Formerly abundant at Bookham (1988–1992) in grassy areas with light scrub, this wild cockroach has become very scarce in recent years. *Tetrix undulata*, the common ground-hopper, was plentiful by sweeping at the margin of IoW Pond.

13.viii.2005: Grasshoppers and bush-crickets Field Study Day. As the party crossed Central Plain, Sarah Barnes discovered a reddish-brown grasshopper with conspicuous knobbed butterfly-like antennae which turned out to be a male rufous grasshopper *Gomphocerripus rufus*. Searching soon revealed a second specimen indicating the presence of a small colony just as was previously reported from Bookham Common about ninety years ago (Lucas 1920). The only recent record for this species at Bookham was the discovery of a single specimen by Seth Gibson on IoW Plain on 26.vii.2001 (Menzies and Barclay 2002). The presence of this species on the London Clay is of interest as most colonies are confined to chalk or limestone hillsides. Twenty minutes later Sarah Barnes and Gavin Hawgood discovered several specimens of the lesser marsh grasshopper *Chorthippus albomarginatus* in the lakeside vegetation of IoW Pond, which appears to be the first record for this species at Bookham. Colonies of *C. albomarginatus* have also been noticed this summer, for the first time in recent years, by the Great Pond on Epsom Common (ISM, 27.viii.2005) and in marshy areas on Wisley Common (ISM, 10.viii.2005) so that this species is evidently 'on the move' in north Surrey. To complete the hat-trick Gavin Hawgood found a female short-winged conehead bush-cricket *Conocephalus dorsalis*, also in the vegetation by IoW Pond. This species has not been seen at Bookham since 1997 (Menzies 1999) and may therefore be in the process of returning. Both common and slender ground-hoppers (*Tetrix undulata* and *T. subulata* respectively) were found to be thriving at the margin of IoW Pond. Unfortunately 'rain stopped play' halfway through the afternoon.

15.viii.2005: Bookham Common 14.15–16.30. The long-winged conehead *Conocephalus discolor*, meadow grasshopper *Chorthippus parallelus* and Roesel's bush-cricket *Metrioptera roeselii* were all found to be abundant in most open grassy areas. At least five lesser marsh grasshoppers *Chorthippus albomarginatus* were found at a second site, on the Central Plain, TQ126560.

21.viii.2005: Bookham Common 14.30–16.00. A fine day: three more rufous grasshoppers were found on the Central Plain site, together with *C. brunneus*, *C. parallelus, Conocephalus discolor, Metrioptera roeselii* and a single speckled bush-cricket *Leptophyes punctatissima*.

30.viii.2005: two female rufous grasshoppers were seen at the Central Plain site, together with further *C. albomarginatus*. *Chorthippus brunneus* was plentiful at the border of Bank's Path, on IoW Plain and Western Plain, evidently doing well in this warm dry summer.

Beetles: field notes for 2005 (Ian Menzies)

11.iv.2005: 4 and 2 examples, respectively, of the tiny ladybirds *Clitostethus arcuatus* and *Nephus quadrimaculatus* were beaten from ivy growing on oak and hazel at the side of Common Road near IoW Pond.

14.v.2005: 4 *Grammoptera ruficornis*, 1 *Tetrops praeusta*, and 1 *Clytus arietis* (longicorn beetles) were beaten from flowering hawthorn.

25.v.2005: single examples of both black-headed *Pyrochroa coccinea* and red-headed *Pyrochroa serraticornis* cardinal beetles were seen flying along the rides in the sunlight.

11.vi.2005: while pond dipping with Eric Groves numerous leaf beetles *Chrysolina polita* and the spectacular *Chrysolina herbacea* (= *menthastri*) were found on *Mentha aquatica*, also several carabid beetles, both *Elaphrus riparius* and *E. cupreus*, were observed running on mud at the margin of Isle of Wight Pond.

21.vi.2005: single examples of the leaf-beetles *Phytodecta decemnotata* and *Chrysomela populi* were found on aspen, and several chafer beetles *Hoplia philanthus* seen flying in the sun over hawthorn bushes on Bayfield Plain. The last species, although not uncommon, does not appear to have been previously recorded from Bookham Common.

9.vii.2005: leaf beetles: *Chrysolina herbacea* (= *menthastri*) and *C. polita*, *Chrysomela populi, Gastrophysa viridula*, and *Phyllobrotica quadrimaculata*, also single examples of the wasp-mimicking longicorn beetle *Strangalia quadrifasciata*, and devil's coach-horse beetle *Staphylinus olens* were found during the course of the Dragonflies and other insects Study Day, led by Neil Anderson (see report).

8.x.2005: a single specimen of the local weevil *Nanophyes gracilis* was found by sweeping in the vicinity of the foodplant, water purslane *Lythrum* (= *Peplis*) *portula*, at the margin of IoW Pond. Recently dead turkey oaks *Quercus cerris* in Kelsey's Wood had been attacked by thousands of the oak-boring beetle *Platypus cylindrus* producing conspicuous masses of yellow frass covering the lower part of the trunks. This species, previously considered a rarity, has much increased in recent years.

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Sawflies (Andrew Halstead)

Sawflies are insects of the order Hymenoptera, which also includes ants, bees and wasps. Sawflies are considered to be the more primitive types of hymenopterous insects and they are placed in the suborder Symphyta. The larvae of sawflies all feed on plants, mainly on the foliage, but some are stem-borers or develop inside fruits or galls. Currie (1969) published 'A preliminary list of sawflies of Bookham Common', which named 169 species. Most of these were recorded during the 1940s and early 1950s. The total list for Britain is about 500 species, so sawflies are well represented on Bookham Common.

On 2.vii.2000 and 23.viii.2000; 20.v.2001, 10.vi.2001 and 9.ix.2001; 17.iv.2004, 16.v.2004, 19.vi.2004 and 2.viii.2004, I made some visits to Bookham Common (TQ1256) to record sawflies and other insects. My list of sawflies was 69 species, of which 17 were not on Currie's list. The apparent decline in species numbers is likely to be due to differences in collecting effort, rather than any changes in the habitat. Some of the species in Currie's list that I failed to find are very common and widespread species that are unlikely to have gone from the Common.

In the list below, I have used the species names given in the Royal Entomological Society's checklist (Kloet and Hincks 1978). Those species names given with an asterisk were also recorded in Currie's list; the earlier dates for those species are not given here. The host plants are given for each species, where known. Unless stated otherwise, the larvae feed by eating holes in the foliage, sometimes resulting in severe defoliation.

Sawflies recorded on Bookham Common

PAMPHILIIDAE

***Neurotoma mandibularis* (Zaddach & Brischke).** Male swept from birch, 11.v.1947 (Currie 1969). Larvae feed in rolled oak leaves. A rarely recorded species.

***Pamphilus pallipes* (Zetterstedt).** Two females on birch, 25.iv.1948 (Currie 1969). Larvae feed in rolled birch leaves. Not common.

***Cephus nigrinus* Thomson.** Male, 16.v.2004. Stem borer in grass, *Poa pratensis*. Not common.

***Cephus pygmaeus* (Linn.).** Males, 9.vi and 23.vi.1946 (Currie 1969). Larvae bore in the stems of many grasses and cereals. Common in grassy places.

***Calameuta pallipes** (Klug).** Female, 10.vi.2001 and 21.vi.2005. Host plant unknown but probably a stem borer in grasses. Common in grassy places.

XIPHYDRIIDAE

***Xiphydria ?camelus* (Linn.).** Maxwell Barclay found a crushed female, 21.vi.2005. It had lost the legs and antennae and so cannot be separated from the much rarer *X. longicollis* (Geffroy). Assuming it was the widespread *X. camelus*, the larvae bore in the wood of alder and birch.

CEPHIDAE

***Hartigia linearis* (Schrank).** Bred from larvae in the stems of *Agrimonia eupatoria*, vi.1946 (Currie 1969). Widespread in meadows.

***Hartigia nigra* (Harris).** Male, 10.vi.1951 (Currie 1969). Larvae bore in the stems of raspberry and blackberry. Uncommon.

***Hartigia xanthostoma** (Eversmann).** Female, 10.vi.2001. Larvae in stems of meadow dropwort *Filipendula ulmaria*. Widespread in damp meadows.

***Janus femoratus* (Curtis).** Male and female, 17.v.1948 and male, 11.vi.1950 (Currie 1969). Larvae bore in oak twigs. Widespread but not common.

***Cephus cultratus** Eversmann.** Female, 10.vi.2001, female, 21.vi.2005 (M. Barclay coll.). Larvae bore in grass stems, such as *Phleum pratense* and *Dactylus glomerata*. Common in grassy places.

ARGIDAE

***Sterictiphora geminata* (Gmelin, in Linnaeus).** Female, 29.v.1949 (Currie 1969). Larvae on rose leaves. Not common.

***Arge clavicornis* Fab.** Male, 20.v.2001. Larvae on birch, widespread in woods.

***Arge cyanocrocea* (Forster).** Female, 15.vi.1938 (L. Parmenter coll.), and 11.vi.1950 (Currie 1969). Larvae on blackberry and raspberry. Common.

***Arge nigripes* (Retzius).** Females, 24.iv and 24.v.1947, 29.v.1949, 11.vi.1950 (Currie 1969). Larvae on rose. Common.

***Arge ochropus* (Gmelin).** Female, 14.viii.1949 (Currie 1969). Gregarious larvae on rose. Not common.

***Arge pagana** (Panzer).** Female, 10.vi.2001, male, 2.viii.2004. Gregarious larvae on rose. Common.

***Arge ustulata** (Linn.).** Male and female, 21.vi.2005 (M. Barclay coll.). Larvae on willow, birch, hawthorn. Common.

CIMBICIDAE

***Zaraea lonicerae* (Linn.).** Males, 6.vi.1946, 30.iv.1950; female, 29.iv.1949 (Currie 1969). Larvae on honeysuckle. Uncommon.

***Abia sericea* (Linn.).** Female, bred vi.1948 by W.H. Spreadbury from larva on *Succisa pratensis* (Currie 1969); flying around *Succisa pratensis*, 11.vii.1994 (Menzies 1995); larva on scabious attacked by the predatory shield-bug *Picromerus bidens*, 11.viii.2001 (Menzies and Barclay 2002). Widespread but not common.

***Cimbex femoratus** (Linn.).** Female, 20.v.2001. Larvae on birch.

***Trichiosoma lucorum* (Linn.).** Male bred from a larva on birch, v.1947; female bred 3.v.1952 from a larva on willow (Currie 1969). Widespread and not uncommon.

***Trichiosoma tibiale* Stephens.** Male bred 25.iv.1947 from a cocoon on hawthorn (Currie 1969). This may be a synonym of *T. lucorum*.

TENTHREDINIDAE: SELANDRIINAE

***Strombocerus delicatulus** (Fallen).** Males, 2.vii.2000 and 10.vi.2001. Larvae on bracken and other ferns. Common in woodland.

***Strongylogaster lineata** (Christ).** Female, 20.v. and 10.vi.2001. Larva on bracken. Common.

***Strongylogaster xanthoceros* (Stephens).** Female, 29.v.1949 (Currie 1969). Larvae on bracken. Widespread but less common than *S. lineata*.

***Aneugmenus padi** (Linn.).** Females, 2.vii.2000; 20.v and 10.vi.2001; 19.vi and 2.viii.2004. Larvae on bracken. Very common.

***Aneugmenus temporalis* (Thomson).** Female, 10.vii.2000. Larvae on bracken. Widespread but less common than *A. padi*.

***Nesoselandria morio** (Fab.).** Female, 10.vi.2001. Larvae on mosses. Common.

***Birka cinereipes** (Klug).** Male, 23.viii.2000; female, 19.vi.2004. Larvae on *Myosotis scorpioides*. Common.

***Selandria serva** (Fab.).** Males, 2.vii.2000 and 10.vi.2001. Larvae on grasses and sedges. Very common in damp meadows.

***Loderus vestigialis** (Klug).** Male, 16.v.2004. Larvae on *Equisetum*. Common.

***Dolerus aeneus* Hartig.** According to Currie (1969), widespread in April–May (years not stated). Larvae on grasses, *Poa* and *Triticum*. Very common in grassy places.

***Dolerus aericeps* Thomson.** According to Currie (1969), abundant in June–August (years not stated). Larvae on *Equisetum*. Very common.

***Dolerus asper* Zaddach.** According to Currie (1969), April–May (years not stated). Larvae on grasses and sedges. Common.

***Dolerus cothurnatus* Lepeletier.** According to Currie (1969), March–June (years not stated). Larvae on *Juncus effusus*. Common.

***Dolerus gonager* (Fab.)** Females, 22.v.1949 and 6.v.1951 (Currie 1969). Larvae on grasses, *Poa, Festuca* and *Agrostis*. Common.

***Dolerus haematodes* Schrank.** According to Currie (1969), in May–June (years not stated). Larvae on sedges, rushes and grasses. Common.

***Dolerus liogaster* Thomson** (including *D. brevitarsus* Hartig). According to Currie (1969), common in May–June (years not stated). *D. brevitarsus* is now recognized as a separate species, *D. varispinus* — see below. *D. liogaster* larvae feed on grasses, *Poa, Festuca, Dactylis*. Common.

***Dolerus madidus** (Klug).** Female, 20.v.2001. Larvae on rushes. Common.

***Dolerus niger* (Linn.).** Male, 2.vi.1946. Larvae on grasses and cereals. Common.

***Dolerus nigratus** (Muller).** Female, 20.v and male, 10.vi.2001; female 16.v.2004. Larvae on grasses, *Holcus* and *Poa*. Common.

***Dolerus nitens* Zaddach.** Female, 27–28.iii.1948 (Currie 1969). Larval host-plant unknown. Uncommon.

***Dolerus picipes* (Klug).** According to Currie (1969) widespread in April–June (years not stated). Larvae on grasses, *Festuca* and *Agrostis*. Very common.

***Dolerus possilensis* Cameron.** Female, 7.viii.1948 (L. Parmenter coll.) (if this was a correct identification, it is a very late date for this species); female, 17.iv.1949 (Currie 1969). Larval host-plant unknown. Not uncommon.

***Dolerus pratensis* (Linn.).** Male, 12.v.1947, female, 2.v.1948 (Currie 1969). Larvae on *Equisetum*. Not common.

***Dolerus puncticollis* Thomson.** Male, 16.iv.1949, female, 30.iv.1949 (Currie 1969). Larval host-plant unknown. Common.

***Dolerus sanguinicollis** (Klug).** Female, 2.vii.2000; male, 10.vi.2001; male, 16.v and male/female, 19.vi.2004. Larvae on grasses. Common.

***Dolerus triplicatus* Klug.** Male, 12.v.1946 (Currie 1969). Larvae on rushes. Not common.

***Dolerus varispinus** Hartig** (formerly *brevitarsus*). Male, 16.v.2004. Larval host-plant unknown. Common.

TENTHREDINIDAE: Heterarthrinae

***Heterarthrus ochropoda* (Klug).** Mines in aspen leaves, 2.vii.2000. Not common.

TENTHREDINIDAE: Blennocampinae

***Athalia bicolor* Lepeletier.** Female, 29.v.1949 (Currie 1969). Larval host-plant unknown. Not common.

***Athalia circularis** (Klug).** Male, 23.viii.2000; female, 20.v.2001; female, 16.v, male/female, 19.vi and male 2.viii.2004. Larvae on *Glechoma hederaceum, Veronica beccabunga, Plantago, Ajuga reptans, Lycopus*. Common.

***Athalia cordata** Lepeletier.** Male, 23.viii.2000; males 16.v and 19.vi, and female 2.viii.2004. Larvae on *Ajuga reptans*. Very common.

***Athalia glabricollis** Thomson.** Male, 2.viii.2004. Larvae on various cruciferous plants. Common.

***Athalia liberta* (Klug).** Male, 27.viii.1938 (H.J. Burkill coll.); females, 9.vi.1946, 28.viii.1949 (Currie 1969). Larvae on *Alliaria petiolata, Cardamine hirsuta* and *Sisymbrium officinale*. Common.

***Athalia lugens** (Klug).** Male, 16.v., and female, 2.viii.2004. Larval host-plants unknown. Common.

***Athalia rosae** (Linn.).** Male, 2.viii.2004. Larvae on a wide range of cruciferous plants. Common in some years.

***Athalia scutellariae* Cameron.** Male, female, 19.vi.2004; 21.vi.2005 (M. Barclay coll.). Larvae on *Scutellaria*. Not uncommon.

***Empria alector* Benson.** Female, 14.v.1950 (Currie 1969). Larvae on *Filipendula ulmaria*. Not common.

***Empria baltica* Conde.** Female, 22.v.1949 (Currie 1969). Larvae on *Filipendula ulmaria*. Common.

***Empria candidata* (Fallen).** Male, 12.v.1947; female, 24.iv.1949, 30.iv.1950 (Currie 1969). Larvae on birch. Not common.

***Empria excisa* (Thomson).** Females, 9 and 23.vi.1946 (Currie 1969). Larval host-plant unknown. Common.

***Empria immersa* (Klug).** Male and female, 16.v.2004. Larvae on willow. Not common.

***Empria liturata* (Gmelin).** Females, 18.iv.1948 and 1.v.1949 (Currie 1969). Larvae on *Fragaria vesca* and *Geum*. Common.

***Empria longicornis* (Thomson).** Males, 24.v.1947 and 24.iv.1949 (Currie 1969). Larvae on raspberry. Uncommon.

***Empria pumila* (Konow).** Females, 22.v.1949 (Currie 1969). Larval host-plant possibly *Filipendula ulmaria*. Not common.

***Empria tridens* (Konow).** Males, 24.v.1947, 25.iv.1948; female, 6.v.1951 (Currie 1969). Larvae on *Geum* and *Rubus*. Not uncommon.

***Ametastegia albipes* (Thomson).** Male and female, 10.vi.1951 (Currie 1969). Larvae on aspen. Not uncommon.

***Ametastegia equiseti** (Fallen).** Male, 20.v.2001. Larvae on *Rumex, Polygonum, Chenopodium* and *Plantago*. Common.

***Protoemphytus carpini* (Hartig).** Male, 2.vii.2000. Larvae on *Geranium*. Common.

***Protoemphytus pallipes* (Spinola).** Male, 15.iv.1949; females, 12.v.1947 and 10.vi.1951 (Currie 1969). Larvae on *Viola*. Common.

***Protoemphytus tener* (Fallen).** Males, 2.vi.1946, 10.vi.1951; female, 25.iv.1948 (Currie 1969). Larvae on *Rumex*. Common.

***Allantus calceatus** (Klug).** Female, 20.v.2001. Larvae on *Filipendula ulmaria* and other Rosaceae plants. Common.

***Allantus cinctus* (Linn.).** According to Currie (1969), females May–August (years not stated). Larvae on rose and *Fragaria*. Common.

***Allantus cingulatus** (Scopoli).** Female, 16.v.2004. Larvae on rose and *Fragaria*. Common.

***Allantus togatus* (Panzer).** Female, 11.vii.1954 (Currie 1969). Larvae on oak, occasionally willow and birch. Not common.

***Apethymus abdominalis* (Lepeletier).** Female, bred x.1946; female, 12.x.1947 (L. Parmenter coll.) (Currie 1969). Larvae on oak. Not uncommon.

***Apethymus braccatus* (Gmelin).** Female, 3.x.1948 (Currie 1969). Larvae on oak. Uncommon.

***Endelomyia aethiops* (Fab.).** Female, 2.vi.1946 (Currie 1969). Larvae skeletonize rose leaves. Common.

***Caliroa annulipes* (Klug).** Females, bred 16.v.1948 from larvae on willow; females, 11.vii.1954 (Currie 1969). Larvae skeletonize the leaves of lime, willow, birch, oak and other trees. Common.

***Caliroa cerasi* (Linn.).** No dates given but Currie (1969) described this as occasional as larvae on hawthorn. Larvae skeletonize the leaves of cherry, pear, hawthorn and other Rosaceae trees and shrubs. Common.

***Caliroa varipes* (Klug).** Larvae on willow, 14.ix.1947 and 3.x.1948. Common. Currie (1969) also recorded a female on aspen, 29.vi.1947. Larvae of *C. varipes* skeletonize the leaves of oak, birch and willow, but not aspen. Another species, *C. tremulae* Chevin, which is associated with aspen, is now recognized as occurring in Britain. Prior to the 1980s, this was misidentified as *varipes*, so it is possible that Currie's aspen record refers to *Caliroa tremulae*.

***Eutomostethus ephippium** (Panzer).** Females, 2.vii.2000; 10.vi.2001; 19.vi.2004; 21.vi.2005 (M. Barclay coll.). Larvae on *Poa* and other grasses. Common.

***Eutomostethus gagathinus* (Klug).** Males, 9.vi.1946, 29.vi.1947 (Currie 1969). Larval host-plant unknown. Not common.

***Eutomostethus luteiventris** (Klug).** Females, 2.vii.2000; 10.vi.2001; 19.vi.2004; 21.vi.2005 (M. Barclay coll.). Larvae on *Juncus effusus*. Common.

***Stethomostus fuliginosus** (Schrank).** Males, 2.vii and 23.viii.2000; 19.vi.2004. Larvae on *Ranunculus*. Common.

***Phymatocera aterrima* (Klug).** Female, 9.v.1948 (L. Parmenter coll.) (Currie 1969). Larvae defoliate Solomon's seal. Common, especially in gardens.

***Rhadinoceraea micans* (Klug).** Male and female, 16.v.2004, Larvae on *Iris pseudacorus*. Common.

***Monophadnus pallescens* (Gmelin).** Females, 2.vii.2000 and 17.iv.2004. Larvae on *Ranunculus*. Common.

***Periclista albida** (Klug).** Female, 16.v.2004. Larvae on oak. Not uncommon.

***Periclista lineolata* (Klug).** According to Currie (1969), males and females April–May (years not stated). Larvae on oak. Not uncommon.

***Periclista pubescens* (Zaddach).** Female, 25.v.1941 (L. Parmenter coll.) (Currie 1969). Larvae on oak. Not common.

***Ardis brunneiventris* (Hartig).** Female, 5.v.1946 (Currie 1969). Larvae bore in rose shoot tips. Widespread but not common.

***Blennocampa pusilla** (Klug).** Females, 10.vi.2001 and 16.v.2004. Larvae feed inside rolled rose leaves. Very common.

***Claremontia alternipes* (Klug).** Female, 20.v.2001. Larvae on raspberry. Not uncommon.

***Claremontia confusa** (Konow).** Female. 17.iv.2004. Larvae on *Poterium sanguisorba, Fragaria, Potentilla.* Common.

***Halidamia affinis* (Fallen).** Female, 9.vi.1946 (Currie 1969). Larvae on *Galium* spp.. Common.

***Scolioneura betuleti** (Klug).** Leaf mines on birch, 10.vi.2001. Very common.

***Messa nana** (Klug).** Female, 10.vi.2001. Larvae mine birch leaves. Common.

***Fenusa pusilla* (Lepeletier).** Female bred from leaf mines on birch, 7.vi.1951 (Currie 1969). Common.

***Fenella nigrita* Westwood.** Mines in leaves of *Agrimonia eupatoria*, 11.vii.1954 (Currie 1969). Not common.

TENTHREDINIDAE: TENTHREDINAE

***Aglaostigma aucupariae** (Klug).** Male, 17.iv.2004. Larvae on *Galium* spp., Common.

***Aglaostigma fulvipes** (Scopoli).** Males, 20.v.2001 and 16.v.2004. Larvae on *Galium* spp., Common.

***Tenthredopsis litterata** (Geoffroy).** Female, 19.vi.2004. Larvae on grasses, *Agrostis, Dactylis, Calamagrostis.* Common.

***Tenthredopsis nassata** (Linn.).** Male, 10.vi.2001. Larvae on grasses, *Agropyron, Deschampsia* and broad-leaved sedges. Common.

***Rhogogaster chlorosoma* (Benson).** Female, 10.vi.2001. Larvae on willow, poplar, alder, *Filipendula ulmaria*. Common.

***Rhogogaster dryas* (Benson).** Female, 29.vi.1947, male, 11.vi.1950 (Currie 1969). Larvae on aspen. Not common.

***Rhogogaster punctulata* (Klug).** Male, 10.vi.2001. Larvae on wide range of deciduous trees. Not uncommon.

***Rhogogaster viridis* (Linn.).** According to Currie (1969), abundant but no dates given. Larvae on alder, willow, poplar and other plants. Common.

***Tenthredo acerrima* Benson.** According to Currie (1969), July–August (no years stated). Larvae on bird's foot trefoil. Common.

***Tenthredo arcuata* Forster.** Females, 13.vii.1947; 17.v and 15.vi.1948 (Currie 1969). Larvae on *Trifolium repens.* Common.

***Tenthredo atra* Linn.** According to Currie (1969), May–June (no years stated). Larvae on a wide range of herbaceous plants. Common.

***Tenthredo celtica* Benson.** According to Currie (1969), May–June on hawthorn flowers (no years stated). Common.

***Tenthredo colon* Klug.** Male, 24.v.1947 (Currie 1969). Larvae on a range of mainly herbaceous plants. Common.

***Tenthredo ferruginea* Schrank.** Females, 26.vi.1946 and 10.vi.1951 (Currie 1969). Larvae on a wide range of plants. Common in woodland.

***Tenthredo livida* Linn.** According to Currie (1969), abundant but no dates given. Larvae on a wide range of plants. Common.

***Tenthredo maculata* Geoffroy**. Females, 9.vi and 16.vi.1946 (Currie 1969). Larvae on grasses, *Brachypodium, Dactylis.* Not common.

***Tenthredo marginella* Fab.** Female, 23.viii.2000; male, 9.ix.2001; female, 2.viii.2004. Larvae on *Mentha* spp. Common.

***Tenthredo mesomelas* Linn.** Male, female, 10.vi.2001, female, 19.vi.2004. Larvae on a wide range of herbaceous plants. Common.

***Tenthredo schaefferi* Klug.** Female, 9.ix.2001. Larvae on *Vicia cracca*. Not uncommon.

***Tenthredo scrophulariae* Linn.** Males bred from larvae on *Scrophularia*, vi.1947; females, 20.vii and 10.viii.1947 (Currie 1969). Larvae on figworts. Common.

***Pachyprotasis rapae* (Linn.).** Female, 2.vii.2000. Larvae on a wide range of mostly herbaceous plants. Very common.

***Macrophya alboannulata* Costa.** Male, 16.v.2004. Larvae on elderberry. Common.

***Macrophya annulata* (Geoffroy).** Male, 16.v.2004. Larvae on *Potentilla reptans.* Common.

***Macrophya duodecimpunctata* (Linn.).** According to Currie (1969), numerous in vi.1946. Larvae on grasses and sedges. Not uncommon in wet places.

***Macrophya ribis* (Schrank).** Female, 4.vi.1949 (Currie 1969). Larvae on elderberry. Common.

TENTHREDINIDAE: NEMATINAE

***Cladius difformis* (Panzer).** Female, 2.viii.2004. Less common than *C. pectinicornis.*

***Cladius pectinicornis* (Geoffroy).** According to Currie (1969), April–May and August (no years stated). Larvae on rose and *Fragaria*. Common.

***Priophorus morio* (Lepeletier).** Males, 11.viii.1946, 24.v.1947, 22.v.1949; female, 17.vii.1937 (Currie 1969). Larvae on *Rubus*. Common.

***Priophorus pallipes* (Lepeletier).** Female, 2.vii.2000. Larvae on a wide range of mostly trees and shrubs. Common.

***Priophorus pilicornis* (Curtis).** Males, 2.vii.2000; 20.v.2001, 19.vi.2004. Larvae on hawthorn. Common.

***Hoplocampa chrysorrhoea* (Klug).** No dates given but said by Currie (1969) to be abundant at blackthorn flowers. Strangely absent on 17.iv.2004. Larvae feed inside blackthorn/sloe fruits. Common.

***Hoplocampa crataegi* (Klug).** Male, 17.iv.2004, female, 16.v.2004. Larvae feed inside hawthorn berries. Common.

***Hoplocampa flava* (Linn.).** Females, 15.iv and 1.v.1949 on blackthorn flowers (Currie 1969). Larvae feed inside plum fruits. Not common but occasionally a pest in gardens.

***Hoplocampa pectoralis* Thomson.** No dates given by Currie (1969) but said to be common at hawthorn flowers. Larvae feed inside hawthorn berries. Common.

***Hoplocampa rutilicornis* (Klug).** Female, 17.iv.2004. Larvae feed inside blackthorn/sloe fruits. Much less common than *H. chrysorrhoea*.

***Hemichroa australis* (Lepeletier).** Females, 2.vi.1946, 13.viii.1950; females bred from larvae on birch, v.1951 (Currie 1969). Larvae on alder, birch. Common.

***Hemichroa crocea* (Geoffroy).** No dates given by Currie (1969) but larvae said to be sometimes abundant on birch. Common.

***Dineura stilata* (Klug).** Female, 2.vi.1946 (Currie 1969). Larvae on hawthorn. Not uncommon.

***Pristiphora alpestris* (Konow).** Female, bred 7.iv.1948 from larva on birch (Currie 1969). Not common.

***Pristiphora biscalis* (Forster).** Female, 12.v.1946 (Currie 1969). Larvae on blackthorn. Not Common.

***Pristiphora coniceps* Lindqvist.** Female, 20.v.2001. Larvae on willow. Common.

***Pristiphora moesta* (Zaddach).** Gregarious larvae on crab apples, 1946–1948 (Currie 1969). Not common.

***Pristiphora monogyniae** (Hartig).** Male, 17.iv and female, 16.v.2004. Larvae feed in rolled leaves of blackthorn. Common.

***Pristiphora punctifrons** (Thomson).** Male, female, 20.v.2001. Larvae on rose. Not uncommon.

***Pristiphora quercus* (Hartig).** Female, 24.v.1953 (Currie 1969). Larvae on birch. Not uncommon.

***Pristiphora ruficornis* (Olivier).** Female bred from larva on birch, v.1951 (Currie 1969). Common.

***Pristiphora testacea* (Jurine).** Female, bred 30.viii.1950; males and females bred v.1951 from larvae on birch (Currie 1969). Not uncommon.

***Amauronematus amentorum* (Forster).** Females, 6.iv.1946 and 12.iv.1947 (Currie 1969). Larvae feed on catkins of goat willow and other *Salix*. Uncommon.

***Amauronematus amplus* Konow.** Females, bred iv.1948 from larvae on birch, female, bred 10.v.1954 (Currie 1969). Not common.

***Amauronematus histrio* (Lepeletier).** According to Currie (1969), March–April (no years stated). Larvae on sallows. Common.

***Amauronematus humeralis* (Lepeletier).** Females, 6.iv.1946, 13.iv.1947 (Currie 1969). Larvae on *Salix atrocinerea.* Common.

***Amauronematus leucolaenus* (Zaddach).** Females, 28.iii.1948 (Currie 1969). Larvae on *Salix atrocinerea, S. aurita* and *S. repens*. Not common.

***Amauronematus longiserra* (Thomson).** Female, 31.iii.1946 (Currie 1969). Larvae on *Salix aurita*. Not common.

***Amauronematus puniceus* (Christ).** Females, 18.v.1947 and 24.v.1953 (Currie 1969). Larvae on aspen. Not common.

***Amauronematus viduatus* (Zaddach).** According to Currie (1969), March–April (no years stated). Larvae on *Salix* spp. Common.

***Euura atra** (Jurine).** Female, 20.v.2001. Larvae in stem galls on *Salix* spp. Common.

***Euura mucronata** (Hartig).** Females, 20.v.2001 and 16.v.2004. Larvae develop in bud galls on *Salix* spp. Common.

***Euura venusta* (Zaddach).** Noted by H.J. Burkill in 1946, and by M. Niblett in 1941 as petiole galls on *Salix caprea* and *S. atrocinerea* respectively (Currie 1969). Not uncommon.

***Phyllocolpa leucapsis* (Tischbein).** Females, 20.v.2001 and 16.v.2004. Larvae feed under folded leaf margins on sallows. Common.

***Phyllocolpa leucosticta** (Hartig).** Female, 20.v.2001, male, 16.v.2004. Larvae feed under folded leaf margins on sallows. Common.

***Pontania bridgmanii* (Cameron).** Bean galls on the leaves of *Salix caprea* and *S. atrocinerea* recorded by H.J. Burkill in 1946 and M. Niblett in 1941 (Currie 1969). Common.

***Pontania proxima* (Lepeletier).** Bean galls on the leaves of *Salix fragilis* recorded by H.J. Burkill in 1946 and M. Niblett in 1941 (Currie 1969).

***Croesus septentrionalis* (Linn.).** According to Currie (1969), gregarious larvae often abundant on birch. No dates given. Larvae also feed on hazel, alder and poplar. Common.

***Nematus bergmanni** Dahlbom.** Female, 10.vi.2001. Larvae on *Salix* sp. Common.

***Nematus brevivalvis* Thomson.** Female, 5.v.1946 (Currie 1969). Larvae on birch. Not common.

***Nematus crassus* (Fallen).** Males, 22–24.v.1949; females, 16.vi.1946, 29.v.1949 (Currie 1969). Larvae on willow, birch, poplar and *Rumex*. Not uncommon.

***Nematus hypoxanthus* Forster.** Female bred from larva on birch, 1954 (Currie 1969). The usual host plants of this species are willow and poplar. Not common.

***Nematus lucidus** (Panzer).** Female, 20.v.2001, male, 16.v.2004. Larvae on hawthorn and blackthorn. Common.

***Nematus melanaspis* Hartig.** Female, 11.vii.1954 (Currie 1969). Larvae on willow, poplar and birch. Common.

***Nematus melanocephalus* Hartig.** Female, 11.vii.1954 (Currie 1969). Larvae on willow, also birch, hazel, poplar and elm. Not uncommon.

***Nematus myosotidis** Fab.** Males, 10.vi.2001, 16.v.2004. Larvae on *Trifolium* and *Onobrychis*. Common.

***Nematus nigricornis* Lepeletier.** Female, bred 8.viii.1954 from larvae on aspen (Currie 1969). Larvae on poplars and willow. Not common.

***Nematus oligospilus* Forster.** Males, 2.vi.1946, 13.viii.1950 (Currie 1969). Larvae on willow. Common.

***Nematus pavidus* Lepeletier.** Females bred from larvae on willow, 4.vi.1948 (Currie 1969). Common.

***Nematus salicis* (Linn.).** Female, 2.vi.1946 (Currie 1969). Larvae on willows. Not uncommon.

***Nematus spiraeae* Zaddach.** Larvae on *Aruncus dioicus* in garden of hotel, vii.1946 (Currie 1969). Unlikely to be found on the wider Common as it is dependant on this garden plant. Common.

***Nematus tibialis* Newman.** Larvae on *Robinia pseudoacacia* in hotel garden, vi.1949 (Currie 1969). Similar status to *N. spiraeae*. Common.

***Nematus viridescens* Cameron.** Females, 5.v.1946, 6.vi.1949, 9.v.1954 (Currie 1969). Larvae on birch. Common.

***Pachynematus kirbyi* (Dahlbom).** Males, 22.v.1949, 24.v.1953 (Currie 1969). Larvae on *Carex, Juncus* and *Agrostis*. Common.

***Pachynematus moerens* (Forster).** Males, 12 and 24.iv.1947 (Currie 1969). Larvae on grasses. Not common.

***Pachynematus rumicis* (Linn.).** Females, 24.v.1947, 12.vi.1949 (Currie). Larvae on *Rumex*. Common.

***Pachynematus xanthocarpus* (Hartig).** Female, 3.vi.1950 (Currie 1969). Larvae on grasses. Not common.

Acknowledgements

I would like to thank Ian Menzies for suggesting this article and providing a copy of Currie's paper. My thanks are also due to Maxwell Barclay for some additional records, including one species that eluded both Currie and myself.

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Fungal records for 2005

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Abstract

The annual London list of species continues to expand exponentially, as more sites are surveyed by more forayers. Notable finds include 'cinnabar' oysterling *Crepidotus cinnabarinus,* bleach cup *Disciotis venosa* and nail fungus *Poronia punctata* (Red Data List species). The number of sites for zoned rosette *Podoscypha multizonata* has now increased to six with eleven individual specimens. A lawn at Trent Park is identified as London's best site for waxcaps (*Hygrocybe* spp.).

Introduction

This is the third annual report on fungi recorded in London and reported to me. Already one trend is evident; the numbers of records, species, sites and reporters has increased substantially each year. For comparison the number of records/species are 120/86 (2003), 253/166 (2004) and 537/261 (2005). This mainly reflects recorder effort, although the summer of 2003 was historically dry and hot, reducing the autumn flush to mainly lignicolous species, and the autumn of 2004 was satisfactorily (to a mycologist) wet. Rainfall is only one of many determinants of fungal fruiting body appearance, other factors apart from temperature being uncertain. Each season fungi respond to some unique combination of conditions so that a species, formerly rare or even unknown, may fruit widely across the country, only to disappear again the following year. Such may be the case for 'cinnabar' oysterling and poplar fieldcap as noted below.

This year has been marked by the long-awaited publication of the *Checklist of the British and Irish Basidiomycota* (Legon and Henrici 2005), a monumental work of scholarship which instantly became the indispensable reference for names, distribution and much else. The scientific names of Basidiomycetes in this report are all according to the 2005 print edition. Subsequently the checklist will be updated online to keep pace with the rapidly changing taxonomy of fungi, now increasingly influenced by molecular data. The English names used here follow the Plantlife report (Holden 2000), with my own efforts at vernacular supplied in quotation marks where no recommended name is available at the species or genus level.

Forays

A spring foray led by Keir Mottram and Andy Overall was held under the auspices of the London Natural History Society, in East Finchley Cemetery. A variety of early fruiting species was found including St George's mushroom *Calocybe gambosa* and bleach cup *Disciotis venosa,* the latter only recorded once before in Middlesex. A foray in Abney Cemetery Park led by Gina Rackley and Jo Weightman was well attended and produced many species of interest including bark bonnet *Mycena speirea*, grey coral *Clavulina cinerea,* sepia webcap *Cortinarius decipiens* and 'white fleshed' poison pie *Hebeloma leucosarx.*

Hampstead Heath forays with Andy Overall produced clustered mushroom *Agaricus vaporarius*, piggyback rosegill *Volvariella surrecta* (on clouded agaric *Clitocybe nebularis*) and chestnut bolete *Gyroporus castanea*, to name only a few of the more exciting species. Jo Dubiel opened our eyes to the mycological possibilities of Lesnes Abbey Wood in south-east London where a foray led by Keir Mottram produced much of interest, including our first record of a chalk specialist, the magpie inkcap *Coprinus picea*. The Haringey Grand Foray was very well attended as usual with well over a hundred species found, of which a good proportion was later sampled in the traditional fry-up at the conservation hut on Railway Fields. This site, one of the smallest local nature reserves in London, seldom fails to produce new species of interest such as this year's frosty webcap *Cortinarius hemitrichus*, cushion bracket *Phellinus pomaceus*, green brittlegill *Russula aeruginea* and the reappearance of 'splendid' porecrust *Auriculariopsis ampla*. A foray at Tower Hamlets Cemetery Park, the first for the excellent friends of the Cemetery, yielded fifty species, a fine haul for a single site, including giant funnel *Leucopaxilus giganteus* and giant puffball *Calvatia gigantea*. As this is now Keir's local park I expect many more records from the site. Trent Park was visited by different individual forayers throughout the year with exceptional results as noted below.

Notable finds

Each year produces some fungi new to our area or previously very scarce for reasons noted above or because the species is a recent immigrant or because no one has looked for it before. Our recorder coverage is a mere fraction of that devoted to the feathered tribe, and as in birdwatching almost anything can turn up almost anywhere. For example consider that spectacular red native of Australia 'Archer's starfish' *Clathrus archeri*, which appeared at Kew flourishing amongst rich leaf litter where it was spotted by Alic Henrici (co-author of the *Checklist*). I do not, as a rule, include any Kew records since they are already compiled by the world's finest fungal taxonomists, but because some of our members went to view this amazing alien, it merits a place here. Perhaps it will soon start to appear in gardens all over the capital.

Another bright red rarity turned up at the entrance to Alexandra Park in time for the annual Haringey foray. 'Cinnabar' oysterling *Crepidotus cinnabarinus* had only thirteen records in the BMSFRD up to last year, mostly from two sites in southern England, but it is not uncommon in Europe and North America. Nick Legon at Kew (the other co-author of the *Checklist*) confirmed my identification from an exsiccate I sent to the herbarium and commented that three other records from new sites had come in to him in 2005 and that *C. cinnabarinus* seems to be spreading. The Alexandra Park site had only come to light as a result of clearance around the trunk of a fallen ash. Intervention by David Bevan ensured that the contractors replaced the logs bearing fruiting bodies in a suitable position in shade.

The most important find of the year must be Mark Spencer's discovery of the nail fungus *Poronia punctata* in a field grazed by ponies in south London. This species has declined severely across Europe in recent decades as it depends on the presence of horses *Equus caballus* that graze on unimproved pasture and are themselves not given antifungal medication. It fruits exclusively on horse droppings where it is easily recognizable by its small flat heads neatly decorated with evenly spaced tiny black dots.

Waxcaps featured in last year's report as I had requested forayers to send in records of grassland sites with six or more species identifiable at a single visit, the number required to identify a site as regionally important for conservation (Evans 2003). Three sites were so identified: Alexandra Park, Kensal Green Cemetery and Trent Park. In 2005 Keir Mottram revisited the lawn at Trent Park and was able to find twelve *Hygrocybe* species at a single visit, which takes the site up to the conservation level of national importance (eleven to fourteen

species at one visit) and makes it the best site in our area, even surpassing Kew in this respect. I do not know if the managers of Trent Park are aware of their lawn's importance or of the measures necessary to conserve its value to mycology, i.e. no fertilizers or weedkillers should ever be applied to it.

Zoned rosette *Podoscypha multizonata* has been noted before in these reports for its two well-known specimens in Alexandra Park and a new site reported last year by Mark Spencer — Beckenham Place Park. We now have records of nine more specimens at four more sites thanks to Sylvia Starshine, whose meticulous recording in Highgate Woods bought three specimens to our attention, and Keir Mottram's further researches in Queen's Wood, Trent Park and Kenwood. He and Mark Spencer have penned an article on the status of the zoned rosette in London for the mycological literature. The fruit body comes in two forms, robust or delicate. It has the interesting habit of reappearing each year at exactly the same spot over a buried root of the host tree, either oak or beech; hence my reference to individual specimens.

Notable for its much reduced appearance was poplar fieldcap *Agrocybe cylindracea*. It was found at several sites last year (only two appear in the list, although I had casual records of three more) but was represented by only a single record in 2005.

Pictures of these species may be viewed on our website (http://uk.groups.yahoo.com/group/londonfungi/).

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LONDON FUNGI RECORDS, 2005

Taxonomic index

ANAMORPHIC FUNGI

HYPHOMYCETOUS ANAMORPH

Calcarisporium arbuscula

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

ASCOMYCOTA

Hypocreales

Hypocreaceae

Hypomyces chrysospermus

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Nectria cinnabarina

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Leotiales

Leotiaceae

Bisporella citrina

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Pezizales

Helvellaceae

Helvella crispa

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Helvella lacunosa

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

As *Helvella sulcata*, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Morchellaceae

Disciotis venosa

Soil, sandy, cemetery, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: A. Overall, Det.: A. Overall, 28.iv.2005.

Morchella vaporaria

As *Morchella hortensis*, *Quercus ilex*, soil, garden, Site: SE 21, Surrey, Col.: Dilys Gane, Det.: E.G.D. Tuddenham, 26.iv.2005.

Otideaceae

Otidea onotica

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Scutellinia scutellata

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Fraxinus excelsior, log, dead, woodland, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: E.G.D. Tuddenham, 1.i.2005.

Pezizaceae

Peziza micropus

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Peziza vesiculosa

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Xylariales

Xylariaceae

Daldinia concentrica

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Fraxinus excelsior, log, dead, parkland & scattered trees, Site: Ruskin Park, TQ325757, Surrey, Col.: H. Brindley, Det.: H. Brindley, 25.iii.2005.

Poronia punctata

Dung, grassland, Site: South London, Col.: M. Spencer, Det.: M. Spencer, 27.x.2005.

Rosellinia aquila

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Xylaria hypoxylon

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Betula, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

BASIDIOMYCOTA

BASIDIOMYCETES

AGARICALES

Agaricaceae

Agaricus arvensis

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Neutral grassland, Site: Ruskin Park, TQ325757, Surrey, Col.: H. Brindley, 28.iv.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Agaricus dulcidulus

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Agaricus langei

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Agaricus moelleri

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Agaricus osecanus

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Agaricus silvaticus

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Agaricus silvicola

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Agaricus vaporarius

Parkland & scattered trees, Site: Hampstead Heath, TQ276862, Middlesex, Col.: K. Mottram, Det.: A. Overall, 3.ix.2005.

Agaricus variegans

As *Agaricus impudicus*, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Agaricus xanthodermus

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Cystoderma amianthinum

Site: Gunnersbury Triangle, TQ200786, Middlesex, Det.: Alic Henrici, 25.ix.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Cystolepiota echinacea

As *Lepiota echinacea*, Site: Epping Forest, TQ411977, Middlesex, Col.: J. Woodward, Det.: K. Mottram, 18.ix.2005.

Cystolepiota sistrata

As *Cystolepiota seminuda*, woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Lepiota aspera

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: K. Mottram, 10.ix.2005.

Lepiota cristata

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Holland Park, TQ247796, Middlesex, Col.: K. Mottram, 24.ix.2005.

Lepiota subincarnata

Site: Gunnersbury Triangle, TQ200786, Middlesex, Det.: Alic Henrici, 25.ix.2005.

Leucoagaricus leucothites

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Macrolepiota procera

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, 16.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, 6.ix.2005.

Macrolepiota rhacodes

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, 16.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Macrolepiota rhacodes, basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Melanophyllum haematospermum

Site: Holland Park, TQ247796, Middlesex, Col.: K. Mottram, 24.ix.2005.

Amanitaceae

Amanita citrina

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Amanita fulva

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Amanita muscaria

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Amanita pantherina

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Amanita rubescens

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Bolbitiaceae

Agrocybe cylindracea

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Agrocybe pediades

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: Anon., Det.: A. Overall, 1.v.2005.

Agrocybe praecox

Wood chips, garden, Site: Avenue Gardens, TQ304905, Middlesex, Col.: E.G.D. Tuddenham, Det.: K. Mottram, 27.iv.2005.

Bolbitius vitellinus

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Coprinaceae

Coprinus atramentarius

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Cavanagh, Det.: K. Cavanagh, 1.v.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Coprinus comatus

Grassland, Site: Kingsley Court, TQ306911, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 25.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Coprinus congregatus

Wood chips, grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Coprinus disseminatus

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Coprinus lagopus

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Coprinus leiocephalus

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: K. Mottram, Conf.: A. Overall, 1.v.2005.

Coprinus micaceus

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Coprinus plicatilis

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Lacrymaria velutina

As *Lacrymaria lacrymabunda*, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Lacrymaria lacrymabunda*, woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

As *Lacrymaria lacrymabunda*, grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Panaeolina foenisecii

Grassland, Site: Kingsley Court, TQ306911, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 7.xi.2005.

As *Panaeolus foenisecii*, woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Psathyrella candolleana

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Psathyrella conopilea

As *Psathyrella conopilus*, woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Psathyrella multipedata

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Psathyrella piluliformis

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Psathyrella spadicea

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Psathyrella spadiceogrisea

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Entolomataceae

Entoloma papillatum

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Entoloma rhodopolium

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Entoloma sericeum

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Rhodocybe gemina

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Hygrophoraceae

Hygrocybe calyptriformis

Grassland, Site: Kensall Green Cemetery, TQ232825, Middlesex, Col.: A. Overall, Det.: A. Overall, 4.xi.2005.

Hygrocybe ceracea

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe coccinea

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe colemanniana
Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe conica
Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe flavipes
Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe glutinipes
Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe laeta
Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe miniata
Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, Conf.: A. Overall, 31.x.2005.

Hygrocybe pratensis
Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe psittacina
Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Hygrocybe quieta
Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Hygrocybe virginea
Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Pluteaceae

Pluteus aurantiorugosus
Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Pluteus cervinus
Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Pluteus plautus
Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Pluteus salicinus
Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Volvariella gloiocephala
Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: M. Rawitzer, Det.: A. Overall, 1.v.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Volvariella surrecta

Clitocybe nebularis fruit, dead, parkland & scattered trees, Site: Hampstead Heath, TQ276862, Middlesex, Col.: A. Overall, Det.: A. Overall, 5.xi.2005.

Strophariaceae

Hypholoma fasciculare

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005, Notes: .

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Kuehneromyces mutabilis

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Panaeolus fimicola

Parkland & scattered trees, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 30.vii.2005.

Pholiota aurivella

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Pholiota gummosa

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Pholiota squarrosa

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Stropharia aurantiaca

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: RBG Kew, TQ183767, Surrey, Col.: H. Brindley, Det.: E.G.D. Tuddenham, 2.v.2005.

Stropharia cyanea

As *Stropharia caerulea*, grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

As *Stropharia caerulea*, woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

As *Stropharia caerulea*, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Stropharia caerulea*, Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

As *Stropharia caerulea*, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Stropharia caerulea*, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Stropharia inuncta

Grassland, Site: Kingsley Court, TQ306911, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 7.xi.2005.

Tricholomataceae

Armillaria gallica

Site: Kingsley Court, TQ306911, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 25.x.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Armillaria mellea

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Calocybe carnea

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Calocybe gambosa

Grassland, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: E.G.D. Tuddenham, 28.iv.2005.

Clitocybe agrestis

Populus, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Clitocybe costata

Site: Queen's Wood, TQ288886, Middlesex, Col.: K. Mottram, 8.x.2005.

Clitocybe geotropa

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Clitocybe gibba

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Clitocybe nebularis

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Clitocybe phyllophila

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Clitocybe rivulosa

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Clitocybe vibecina

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Dermoloma cuneifolium

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Flammulina velutipes

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Fraxinus excelsior, log, dead, Site: Alexandra Park, TQ301901, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, 21.i.2005.

Fraxinus excelsior, root, woodland, Site: Ruskin Park, TQ325757, Surrey, Col.: H. Brindley, Det.: H. Brindley, 3.ii.2005.

Gymnopus dryophilus

As *Collybia dryophila*, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Collybia dryophila*, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 30.vii.2005.

As *Collybia dryophila*, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Gymnopus erythropus

As *Collybia erythropus*, heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Gymnopus fusipes

As *Collybia fusipes*, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Collybia fusipes*, woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Laccaria amethystina

As *Laccaria amethystea*, woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

As *Laccaria amethystea*, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Laccaria amethystea*, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Laccaria amethystea*, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Laccaria amethystea*, woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Laccaria laccata

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Lepista flaccida

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Lepista nuda

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Lepista saeva

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Lepista sordida

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Kingsley Court, TQ306911, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 7.xi.2005.

Leucopaxillus giganteus

As *Clitocybe gigantea*, woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Marasmiellus ramealis

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Marasmius oreades

Site: Kingsley Court, TQ306911, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 16.viii.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Melanoleuca polioleuca

Grassland, Site: Kingsley Court, TQ306911, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 7.xi.2005.

Mycena aetites

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Mycena arcangeliana

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Mycena epipterygia

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Mycena filopes

Parkland & scattered trees, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Mycena flavoalba

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Mycena galericulata

Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Mycena galopus

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Mycena haematopus

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Mycena inclinata

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Mycena leptocephala

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Mycena pura

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Mycena pura* var. *rosea

As *Mycena rosea*, woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

As *Mycena rosea*, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Mycena speirea

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Mycena vitilis

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Oudemansiella mucida

Fagus sylvatica, log, parkland & scattered trees, Site: Hampstead Heath, TQ276862, Middlesex, Col.: K. Mottram, Det.: A. Overall, 3.ix.2005.

Panellus stipticus

Site: Kenwood House, TQ271873, Middlesex, Col.: J. Woodward, Det.: K. Mottram, 7.iii.2005.

Rhodocollybia butyracea

As *Collybia butyracea*, woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

As *Collybia butyracea*, woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

As *Collybia butyracea*, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Collybia butyracea*, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

As *Collybia butyracea*, Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Rhodotus palmatus

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Rickenella fibula

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Tricholoma scalpturatum

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Betula, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Tricholoma sulphureum

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Auriculariales

Auriculariaceae

Auricularia auricula-judae

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Auricularia mesenterica

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Boletales

Boletaceae

Boletus edulis

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Leccinum duriusculum

Populus tremula, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 26.vii.2005.

Leccinum scabrum

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Coniophoraceae

Coniophora puteana

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Gyrodontaceae

Gyroporus castaneus

Parkland & scattered trees, Site: Hampstead Heath, TQ276862, Middlesex, Col.: Anon., Det.: A. Overall, 3.ix.2005.

Paxillaceae

Paxillus involutus

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Basic/calcareous grassland, Site: Lesnes Abbey ruins, TQ478788, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Xerocomaceae

Xerocomus badius

As *Boletus badius*, heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

As *Boletus badius*, woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

As *Boletus badius*, *Quercus*, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Xerocomus chrysenteron

As *Boletus chrysenteron*, woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

As *Boletus chrysenteron*, woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

As *Boletus chrysenteron*, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Xerocomus pruinatus

As *Boletus pruinatus*, grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Xerocomus rubellus

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Xerocomus subtomentosus

As *Boletus subtomentosus*, grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Cantharellales

Clavariaceae

Clavulinopsis helvola

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Clavulinopsis luteoalba

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Clavulinaceae

Clavulina cinerea

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Cortinariales

Cortinariaceae

Cortinarius anthracinus

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Cortinarius decipiens

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Cortinarius hemitrichus

Betula, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Gymnopilus junonius

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Hebeloma crustuliniforme

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Hebeloma leucosarx

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

As *Tricholoma leucosarx*, Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Inocybe adaequata

Quercus, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Inocybe calospora

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Inocybe curvipes

Doubtful record, woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Inocybe geophylla

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Crepidotaceae

Crepidotus cinnabarinus

Fraxinus excelsior, log, dead, woodland, Site: Alexandra Park, TQ301901, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 4.xi.2005, Herb.: **K**, Notes: 14th record for UK and a new site to add to probably only two sites on BMSFRD.

Crepidotus mollis

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Crepidotus variabilis

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Dacrymycetales

Dacrymycetaceae

Calocera pallidospathulata

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Fistulinales

Fistulinaceae

Fistulina hepatica

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Ganodermatales

Ganodermataceae

Ganoderma applanatum

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005, Notes: With galls.

Stump, rotten, grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Ganoderma australe

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Ganoderma resinaceum

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Aesculus hippocastanum, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 26.vii.2005.

Hymenochaetales

Hymenochaetaceae

Hymenochaete rubiginosa

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Inonotus hispidus

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Phellinus pomaceus

Prunus avium, branch, fallen, grassland & scrub, Site: Railway Fields, TQ316881, Middlesex, Col.: J. Woodward, Det.: K. Mottram, 21.v.2005.

Prunus, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005. Note: this is the same fruit body as the record above.

Lycoperdales

Geastraceae

Geastrum triplex

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Lycoperdaceae

Bovista plumbea

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Calvatia gigantea

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Handkea excipuliformis

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Lycoperdon nigrescens

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Lycoperdon perlatum

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Lycoperdon pyriforme

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Phallales

Clathraceae

Clathrus archeri

Site: RBG Kew, TQ183767, Surrey, Col.: Alic Henrici, Det.: Alic Henrici, 13.x.2005.

Phallaceae

Mutinus caninus

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Poriales

Coriolaceae

Abortiporus biennis

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: K. Mottram, 16.xi.2005, Notes: Appeared exactly like the illustration of *Hydnellum ferrugineum* on the back cover of B&K volume 2 with bright red guttation. However, closer inspection proved it to be *A. biennis*.

Populus tremula, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 26.vii.2005.

Bjerkandera adusta

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Cerrena unicolor

Site: Gunnersbury Triangle, TQ200786, Middlesex, Det.: Alic Henrici, 25.ix.2005.

Daedaleopsis confragosa

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Datronia mollis

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Grifola frondosa

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Laetiporus sulphureus

Site: Ravensbury Park, TQ265680, Surrey, Col.: I. Glass, 26.v.2005.

Site: Ruskin Park, TQ325757, Surrey, Col.: H. Brindley, Det.: H. Brindley, 26.v.2005.

Meripilus giganteus

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Phaeolus schweinitzii

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: G. Rackley, 17.x.2005.

Piptoporus betulinus

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Rigidoporus ulmarius

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Avenue Gardens, TQ304905, Middlesex, Col..: E.G.D. Tuddenham. Note: This is the same champion specimen illustrated in report for 2003.

Trametes gibbosa

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Trametes versicolor

As *Coriolus versicolor*, woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Tyromyces fissilis

As *Aurantiporus fissilis*, Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Lentinaceae

Pleurotus dryinus

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Polyporaceae

Polyporus badius

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Polyporus leptocephalus, heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Russulales

Russulaceae

Lactarius camphoratus

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Lactarius pubescens

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Lactarius quietus

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Lactarius rufus

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Lactarius subumbonatus

Grassland, Site: Trent Park, TQ288973, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 31.x.2005.

Lactarius tabidus

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Lactarius turpis

As *Lactarius plumbeus*, woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

As *Lactarius plumbeus*, woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Russula acrifolia

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Russula aeruginea

Betula, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Russula amoenolens

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Russula atropurpurea

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Russula betularum

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Russula cyanoxantha

Aesculus, parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Russula fragilis

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Russula graveolens

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Russula grisea

Parkland & scattered trees, Site: Hampstead Heath, TQ276862, Middlesex, Col.: K. Mottram, Det.: A. Overall, 3.ix.2005.

Russula heterophylla

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Russula ochroleuca

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Russula parazurea

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Parkland & scattered trees, Site: Hampstead Heath, TQ276862, Middlesex, Col.: K. Mottram, Det.: A. Overall, 3.ix.2005.

Russula pectinatoides

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Russula risigallina

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Coi.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Russula rosea

As *Russula aurora*, heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Russula sororia

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 20.x.2005.

Russula versicolor

Betula, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Russula vesca

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Russula virescens

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Sclerodermatales

Sclerodermataceae

Scleroderma areolatum

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Scleroderma citrinum

Site: Tottenham Cemetery, TQ332909, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Scleroderma verrucosum

Parkland & scattered trees, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Stereales

Hyphodermataceae

Hyphodontia sambuci

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Meruliaceae

Auriculariopsis ampla

Populus, Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Chondrostereum purpureum

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: Abney Park, TQ333868, Middlesex, Col.: G. Rackley, Det.: Jo Weightman, 29.x.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Phlebia merismoides

As *Phlebia radiata*, heathland, Site: Lesnes Abbey heath, TQ484786, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

As *Phlebia radiata*, woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Podoscyphaceae

Podoscypha multizonata

Quercus, Site: Alexandra Park, TQ301901, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005. Two specimens at exactly the same sites as in previous years near the base of ancient oaks.

Quercus, Site: Highgate Wood, TQ282887, Middlesex, Col.: S. Starshine, Det.: S. Starshine, 8.x.2005. Three specimens found, each at the base of mature oaks.

Quercus, root, woodland, Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, 10.x.2005. One specimen found near an oaK. in the witches' coven circle.

Quercus, root, woodland, Site: Trent Park, TQ288973, Middlesex, Col.: K.Mottram, Det.: K. Mottram, 31.x.2005.

Quercus, root, woodland, Site: Trent Park, TQ288973, Middlesex, Col.: K.Mottram, Det.: K. Mottram, 30.vii.2005.

Fagus sylvatica, root, woodland, Site: Trent Park, TQ288973, Middlesex, Col.: E.G.D. Tuddenham, Det.: E.G.D. Tuddenham, 5.viii.2005.

Fagus sylvatica, root, woodland, Site: Kenwood House, TQ271873, Middlesex, Col.: K. Mottram, Det.: K. Mottram, 25.x.2005.

Quercus, Site: High Beach, Epping Forest, TQ411977, Middlesex, Col.: J. Woodward, Det.: K. Mottram, 18.ix.2005.

Stereaceae

Stereum gausapatum

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Stereum hirsutum

Woodland & scrub, Site: Parkland Walk, TQ302878, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: E.G.D. Tuddenham, 5.xi.2005.

Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, Conf.: K. Mottram, 16.x.2005.

Site: Queen's Wood, TQ288886, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

Site: Railway Fields, TQ316881, Middlesex, Col.: Anon., Det.: K. Mottram, Conf.: A. Overall, 6.xi.2005.

Grassland & scrub, Site: St Pancras and Islington Cemetery, TQ272906, Middlesex, Col.: K. Mottram, Det.: A. Overall, 1.v.2005.

Woodland, Site: Coldfall Wood, TQ276902, Middlesex, Col.: Anon., Det.: K. Mottram, 22.x.2005.

Tremellales

Exidiaceae

Exidia nucleata

Woodland, Site: Lesnes Abbey Wood, TQ480785, West Kent, Col.: J. Dubiel, Det.: K. Mottram, 27.x.2005.

MYXOMYCOTA
MYXOMYCETES
LICEALES
Lycogalaceae

Tubifera ferruginosa
Woodland & scrub, Site: Tower Hamlets Cemetery Park, TQ368823, Middlesex, Col.: Anon., Det.: E.G.D. Tuddenham, 16.x.2005.

537 records, 261 species.

Site references

Abney Park, TQ333868, Middlesex.
Alexandra Park, TQ301901, Middlesex.
Avenue Gardens, TQ304905, Middlesex.
Coldfall Wood, TQ276902, Middlesex.
Gunnersbury Triangle, TQ200786, Middlesex.
Hampstead Heath, TQ276862, Middlesex.
High Beach, Epping Forest, TQ411977, Essex.
Highgate Wood, TQ282887, Middlesex.
Holland Park, TQ247796, Middlesex.
Kensal Green Cemetery, TQ232825, Middlesex.
Kenwood House, TQ271873, Middlesex.
Kingsley Court, TQ306911, Middlesex.
Lesnes Abbey heath, TQ484786, West Kent.
Lesnes Abbey ruins, TQ478788, West Kent.
Lesnes Abbey Wood, TQ480785, West Kent.
Parkland Walk, TQ302878, Middlesex.
Queen's Wood, TQ288886, Middlesex.
Railway Fields, TQ316881, Middlesex.
Ravensbury Park, TQ265680, Surrey.
RBG Kew, TQ183767, Surrey.
Ruskin Park, TQ325757, Surrey.
St Pancras and Islington Cemetery, TQ272906, Middlesex.
Tottenham Cemetery, TQ332909, Middlesex.
Tower Hamlets Cemetery Park, TQ368823, Middlesex.
Trent Park, TQ288973, Middlesex.

People references

A. Overall
Alic Henrici
Anon.
Dilys Gane
E.G.D. Tuddenham
G. Rackley
H. Brindley
I. Glass
J. Dubiel
J. Woodward
Jo Weightman
K. Cavanagh
K. Mottram
M. Rawitzer
M. Spencer
S. Starshine

Associated organism index

Aesculus
Russula cyanoxantha.

Aesculus hippocastanum
Ganoderma resinaceum.

Betula
Cortinarius hemitrichus, Russula aeruginea, Russula versicolor, Tricholoma argyraceum, Xylaria hypoxylon.

Clitocybe nebularis
Volvariella surrecta.

Fagus sylvatica
Oudemansiella mucida.

Fraxinus excelsior
Crepidotus cinnabarinus, Daldinia concentrica, Flammulina velutipes, Scutellinia scutellata.

Populus
Auriculariopsis ampla, Clitocybe agrestis.

Populus tremula
Abortiporus biennis, Leccinum duriusculum.

Prunus
Phellinus pomaceus.

Prunus avium
Phellinus pomaceus.

Quercus
Inocybe adaequata, Podoscypha multizonata, Xerocomus badius.

Quercus ilex
Morchella vaporaria.

Book reviews

A dictionary of animal behaviour. David McFarland. Oxford University Press. 2006. 221 pp., paperback. £10.99. ISBN 0 19 860721 0.

This is an extremely useful and readable survey of terms related directly to animal behaviour, and also with the limited addition of terminology of kindred subjects, especially ecology, physiology and psychology. It is intended to provide a readily accessible starting point for those who wish to learn about the study of animal behaviour as currently practiced by professionals. Throughout the dictionary, asterisks lead the user to cross references to obtain the fuller understanding of a particular term. Many of the examples given are familiar to the naturalist, for instance, the typical links in the food chain of the killer whale via leopard seal, king penguin, squid, Antarctic blennies, krill and plankton. Did you know that certain animals, like chickens and some monkeys, have different alarm calls depending on the type of danger so that their companions know what evasive action to take.

The author is the former head of the Animal Behaviour Research Group at Oxford University.

K. H. Hyatt

A dictionary of ecology. Edited by Michael Allaby. Oxford University Press. Ed. 3, 2005. 473 pp., paperback. £11.99. ISBN 0 19 860905 1.

Ecology has been with us since 1866 when the German, Ernst Haeckel coined the term 'Ökologie' and the English word 'oecology' appeared, but it wasn't until the end of the nineteenth century that what we understand today as the independent discipline of ecology, the interrelationships between living organisms and their environment, really got off the ground.

Nowadays, ecology is such a familiar everyday word that it is sometimes misused in non-scientific situations. However, it is because of the great surge if interest in our environment as more and more demands are made on our planet, either locally or globally, that steady progress in ecology has resulted in the appearance of multitudes of new words. The present edition contains over two hundred more entries than the second edition of seven years previous. It contains over 5,200 entries on all aspects of ecology and related disciplines which makes it ideal for students of biological, environmental and conservation studies, and for the general reader with an interest in the natural world.

K. H. Hyatt

Cladonia in London

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Abstract

An assessment of the lichen genus *Cladonia* in London, with status, identification and habitat notes; and herbarium and field records. Of the 39 taxa treated, 30 are extant, although some with provisos, 4 extinct and 5 excluded. London is the type locality for three species of *Cladonia* — *C. humilis, C. peziformis* and *C. ramulosa*. Plus a short note on 4 species of *Stereocaulon*.

Introduction

As part of a larger project assessing all the taxa recorded for the London area this paper deals with *Cladonia,* an attractive and distinct group that has always been popular with people beginning lichenology. Hill (1751) was the first author to use the genus *Cladonia*; that was nomenclaturally validated by Browne (1756). Linnaeus (1753) placed it, as with all other genera, in the genus *Lichen*; and Acharius (1803), the father of lichenology, placed it under *Baeomyces*, later (1810) renaming it *Cenomyce*. The name *Cladonia* was adopted by most authors following the world monograph by Flörke (1828). *Cladina* Nylander (1866) is used by some authors for part of the group but only as a subgenus in Britain. For a fuller introduction to the history of the genus see Ahti (2000). An attempt to assess the past and current status of this genus in London is made. Although recognizable to genus they are a difficult group to feel confident in naming as chemistry is important, and they can also vary with ecological conditions. According to Ahti (1982) they are a life form group rather than a taxonomic entity. Whether the similarities are due to convergent adaptation or similar ecological conditions is still being debated.

Recording *Cladonia* Hill ex. P. Browne (1756) in London

The earliest records are in Johnson (1629 and 1632 in Gilmour 1972). One of the earliest dated and located specimens for London is a *Cladonia* gathered, possibly by the Revd Adam Buddle (of *Buddleja* fame), on Hampstead Heath in 1696/7 and now in the Sloane herbarium at the Natural History Museum. London is the type locality for three species of *Cladonia* — *humilis, peziziformis* and *ramulosa*, recorded by Withering (Laundon 1984). London is fortunate in having had recorders in certain areas such as Forster (Epping Forest), Crombie (Epping and northern areas), and Laundon (particularly churchyards). The current records are taken from various sources and show a somewhat patchy coverage. It will be noted that many modern records come from Bromley, mainly from Ishpi Blatchley who has been recording regularly particularly from churchyards and cemeteries. Long-term recording means one can build up a pattern of increase and decline in different species.

Laundon (1970) noted twenty-four taxa in a sixteen-kilometre radius of Charing Cross, and my Herbarium paper (Waterfield 2002), covering a wider area, added *C. humilis*, *C. ochrochlora* and *C. squamosa*. Further research and a wider area yielded a total of thirty-nine taxa. Unfortunately some are now extinct in London, such as *C. peziziformis* (whose type locality is Hampstead Heath but alas is now known only from Wales and Scotland); others have been wrongly identified, which shows how important it is to have herbarium specimens; others might be erroneous records. *Cladonia* has been recorded intermittently, but with habitat creation it is important to monitor its appearance. It was the abundance of *Cladonia* colonization on a recently created beetle bank at Hounslow Heath that inspired me to start with this group.* Heathland, often associated with *Cladonia*, is an endangered habitat and threats include eutrophication (especially from dogs), burning, overgrazing, trampling, air pollution and habitat loss. Another threatened habitat is old walls where the current trend of using high pressure hoses to clean presents a particular problem for *Cladonia* and other lichens. Whilst recording *Cladonia* the effect of snail grazing should be noted (Gilbert 2001) — a particularly nice patch of *C. chlorophaea* in the Hill Garden, Hampstead, first recorded in winter, had had all the podetia grazed in the spring thus making it more difficult to identify.

Index Herbariorium notes over forty herbaria in 'London'. Most are now defunct; although some have been amalgamated with the main herbaria at **BM** and **K**. It is a sad reflection of our attitude to natural history that people no longer think it is worth maintaining these herbaria, which are such an important source of voucher material. The lack of access to chemical tests such as TLC (thin layer chromatography) is another problem as computer records alone are not enough. The link between amateur and professional is vital for a healthy understanding of our lichen flora but is now growing more tenuous.

Identifying *Cladonia*

The thallus, or body, of *Cladonia* is usually composed of two parts — a well-developed and persistent foliose to **squamulose primary thallus**; the size, colour, shape and persistence of primary squamules are important, but too variable to be truly diagnostic. In some species the primary thallus (of a granular, dispersed nature) disappears and growth continues from the tips — these are assigned to a subgenus, *Cladina*. The secondary thallus is more or less vertical, sometimes branched, solid or hollow. The word **podetia** was first used by Acharius (1803) to describe these vertical growths. The amount of cortication, and/or soredia (and its size) on the podetia, and type of squamule (peeling or otherwise) should be noted. A peeling squamule leaves a decorticate patch underneath. Scyphi, or **cups**, are another feature of *Cladonia*, giving them the name 'pixie cups', but it should be noted that they do not all have cups. Whether proliferation occurs from the margin or centre of the cup should be noted. The apothecia (fruit bodies) can develop on the horizontal thallus or the tip of the podetia and are without a properly differentiated margin, usually brightly coloured but often brown. Red apothecia can darken with age so care should be used when keying out. The interascal tissue is composed of sparsely branched *paraphyses*; the *asci* have an I+ apical cap and an I+ gelatinous outer layer; *ascospores* are usually not septate. *Pycnidia* can be seen in some species and the colour of the internal jelly can be diagnostic. There are no *cephalodia*. *Cladonia* should be looked for on humus, rotting wood, old walls and heathy places. Several species often grow together so care should be taken in teasing them out.

The secondary chemistry of *Cladonia* is important and can sometimes be related to soredia size (Kristinsson 1971). Huovinen and Ahti (1982) have described the biosequential patterns for *Cladonia*, and the more closely related

* I would like to take this opportunity to correct a mistake: *Cladonia furcata* should replace *C. rangiformis* on the list published for Hounslow in the LNHS *Newsletter* **191**, August 2005.

chemicals can be seen. The biosynthetic pathways mean that some secondary compounds are more closely related than others, for example thamnolic and squamatic acids are closely related. Spot tests can be carried out using P (paraphenylenediamine), K (potassium hydroxide) and C (sodium hypochlorite), or a combination of the latter two. P is useful to see if there is the possibility of fumarprotocetraic acid, a secondary metabolite that often occurs in *Cladonia*.

The Lichen Flora of Great Britain and Ireland (Purvis et al. 1992) is the most comprehensive key to *Cladonia,* but for the amateur, Dobson (2005) includes all the known London *Cladonia* except for *peziziformis* and *rei* (which is difficult to distinguish except with chemistry). Other keys are Fletcher (1984) and Hoggetts (1992). The *Lichen Atlas of the British Isles* Fascicle 2 (Seaward 1996) covers fifty-nine species of *Cladonia*; this is also my source for lichenicolous fungi known to attack *Cladonia* — but I am not aware of any yet recorded in London. Whilst preparing this paper I compiled lists of synonyms but I was unable to check all these; and, as my primary aim was to make records available to a wider public, I have decided to omit these. To find synonyms go first to the British Lichen Society website (www.thebls.org.uk) and further to INDEX FUNGORUM and ITALIC (for a comparison with British usage).

The nomenclature follows Coppins (2002).

List of taxa divided into three groups: extant, extinct and excluded

Extant

1. *arbuscula*
2. *cervicornis c.*
3. *c.* var. *vercillata*
4. *chlorophaea*
5. *ciliata* var. *tenuis*
6. *coniocraea*
7. *crispata* var. *cetrariiformis*
8. *digitata*
9. *diversa (coccifera* agg.*)*
10. *fimbriata*
11. *floerkeana*
12. *furcata*
13. *glauca*
14. *gracilis*
15. *humilis*
16. *macilenta*
17. *ochrochlora*
18. *parasitica*
19. *pocillum*
20. *polydactyla*
21. *portentosa*
22. *pyxidata*
23. *ramulosa*
24. *rangiformis*
25. *rei*
26. *scrabiuscula*
27. *squamosa*
28. *squamosa* ssp. *subsquamosa*
29. *subrangiformis* — see *furcata*
30. *subulata*

Exinct

31. *caespiticia*
32. *convoluta*
33. *peziziformis*
34. *uncialis* var. *biuncialis*

Excluded

35. *bellidiflora*
36. *coccifera*
37. *foliacea*
38. *strepsilis*
39. *subcervicornis*

Each entry contains a description including chemistry; ecology; note if lichenicolous fungi are known to occur on that taxon; and herbarium and field records. Historical records refer to Laundon (1970). Herbarium records come first then field records. Where there are many records they are broken up into boroughs. Records for species imported into London and surviving I count as valid.

To maximize space some of the collectors have been shortened to initials: AA – Ann Allen; AR – A. Richards; BJC – Brian Coppins; BMS – Brian Spooner; BW – Brian Wurzell; DLH – David Hawksworth; EWB – Ted Brown; FHB – Frank Brightman; FR – Francis Rose; IB – Isphi Blatchley, JFS – John Skinner; JLG – John Gilbert; JRL – Jack Laundon; MBAH – Begoña Aguirre-Hudson (sometimes accompanied by KJH, her husband Ken Hudson, and HAH, Harry, her son); PDC – Peter Crittenden; PEB – Peter Earland-Bennett; PJE – Peter Edwards; PMK – Paul Kirk; PWJ – Peter James; SD – Simon Davey.

In the chemistry r = red, y = yellow, o = orange, p = purple, g = green. {CR} is a chemical race. Sqs. – Refers to the 10-km. squares of the BLS Mapping Scheme. Each number should be prefixed by 51. Note: 46 and 47 covers Bromley, 28 Hampstead Heath, 16 Esher Common, 17 Kew.

Collections: **K(M)** is the start of a Kew Mycology Herbtrack (database) entry, with NDB meaning not databased, and **BM** for the Natural History Museum, **SLBI** refers to the South London Botanical Institute.

Notes on taxa

Extant

1. ***Cladonia arbuscula* (Wallr.) Flot.** (1839)
Two subspecies of which the commonest is: **C. *arbuscula* subsp. *squarrosa* (Wallr.) Ruoss** (1987) {CR}
Cladina. Apothecia brown, inconspicuous and rare. Podetia yellowish, has a relatively coarse habit, predominantly 3- to 4-chotomic branching, terminal branches orientated in one direction and usually P + r (fumarprotocetraric acid) the only major substance other than usnic acid. K-, KC+ y, C-, UV -.
Ecology: Heaths. On acid soil generally amongst *Calluna*. A species often found with *C. portentosa* and *C. ciliata* var. *tenuis* (which is more slender with predominantly dichotomic branching) on heathlands.
Host to *Lichenoconium usneae* (Anzi) D. Hawksw.
Historical records and Richmond Park East, 1971, BJC; other records not traced. I have included this in extant but would like to see a voucher for this species to confirm it. Sqs: 16,27,47,46.

2. ***Cladonia cervicornis* (Ach.) Flot.** (1849) **subsp. *cervicornis***
Basal squamules often dominant, grey-green to grey-brown above, white below, often tinged mauve or grey (K-). Podetia with corticated cups, often proliferating from the centre. Ssp. *verticillata* differs in tiers of cups and less well-developed basal squamules. *C. subcervicornis* is K + y and has larger bluish or lead-grey squamules, white below but often blackened towards the base.
Ecology: Predominantly coastal or on sandy soil.
Historical records s.l. and occasional amongst mosses in open acid grassland on abandoned railway sidings, Feltham Marshalling Yard, Hounslow, 8.v.1992, JRL 3238 (herb. Laundon); **K(M)** 68734 Oxshott Heath, W. of station on sandy soil. 20.i.1994 JFS & BMS det. JFS; **K(M)** 124171 Esher Common, Round Hill on sandy soil, 18.iv. 2004, BMS & MBAH, det. MBAH. Sqs: 16,17,46,47.
Note: old records are s.l. but van Herk and Aptroot (2003) have proposed that the three subspecies are raised to species level. *Cladonia cervicornis* (Ach.) Flot. subsp. *pulvinata* differs in P + y reaction and more slender podetia in which each tier is more than twice as tall as wide. It is thought to be rare in the British Isles. Not known in London. I have treated the other subspecies as a separate taxon.

3. ***Cladonia cervicornis* (Ach.) Flot. subsp. *verticillata* (Hoffm.) Ahti** (1980)
Tiers of cups arising from centre of one below, cf. *C. gracilis* where proliferations are marginal; smooth corticated podetia. If cup single usually small peak in centre. Apothecia brown, usually on short stalks on rim of cup. P+ r, K-, KC-, C-.
Ecology: Heaths. Bare acid soil. [More acid soil than subsp. *cervicornis*.]
Historical records and Bromley, Hayes Common, heather patch, TQ412650, 1998, IB. Sqs: 28, 46.

4. ***Cladonia chlorophaea* (Flörke ex Sommerf.) Spreng.** (1827)
Squamules large, lobed with divided or crenellated margins, yellow-green to olive or brown. Podetia arising from centre of squamule, sorediate granules and a few squamules. Coarse clusters of soredia and never smooth granules. Cups often proliferating, granular interior, cf *C. fimbriata* (floury) and *C. pyxidata* (corticated granules). Apothecia brown on proliferations on cup margin. P + r, K -, KC -, C-, UV-. (fumarprotocetraric acid). Note: ***C. chlorophaea*** is a difficult complex and in ITALIC under *pyxidata*.
Ecology: wood, bark, rock, soil, walls.
Historical records and **K(M)**NDB - Sheen Common. Brick wall at north end. W.B. Turrill. 7.xii.1931, Det. JRL 1959 [+ *C. coniocraea*]; **K(M)** 76174 Hounslow Heath, Middx. 6.i.1957. JLG; **K(M)** 76173 On a pathway near the Tennis Court, Kew Gardens. 23.xi.1958 coll. JLG (as *C. pyxidata* var. *chlorophaea*); **K(M)** 103976

Grassy area above lake at end of park past old farm, Painshill Park, Cobham, Surrey. BMS det. JFS Oct 1981; **K(M)** 103974 Esher Common, Surrey. 22.xi.1981, PMK, det. JFS; **K(M)** 103975 Esher Common near A3 bypass, sandy soil. 22.xi.1981, Coll. BMS, det. JFS; **K(M)** 103975 Esher Common near A3 bypass, sandy soil. 22.xi.1981. Coll. BMS, det. JFS; **K(M)** 68731 Esher Common (north) on sandy soil with *Polytrichum* sp. and *Aira praecox*, 20.vi.1994, JFS and BMS, det. JFS; **K(M)** 68711 E. of Black Pond, Esher Common. Peaty soil. 20.xi.1995, JFS and LE Watts. Det. JFS; **K(M)** 110124 Oxshott Heath, Esher, (around sandpit) on soil. 30.iii.2003. MBAH + K + H. Det. MBAH; common and increasing, mostly over top of shallow slopes of old lying trunk, 24.x.1976, South Central Clearing, Perivale Wood LNR [Herb. PJE]; and BROMLEY: Ruxley Gravel Pit, TQ474698, 10.x.1998, IB; St John's churchyard, West Wickham, TQ389649, iii.1995, IB; St Giles, Farnborough, TQ444642, 1990, IB; St Mary the Virgin, Hayes, TQ405663, 1995, IB; London Lane Cemetery, Bromley, TQ398701, 15.iii.1996, IB: City of London Cemetery, Sanderstead 1993; All Saints, Orpington, TQ467665, 8.iii.1998,IB; All Saints Carshalton 1990; Halstead 1998; St Mary's Ewell; Chislehurst Cemetery, TQ454713, 1995, IB; Bromley Hill Cemetery, TQ393707, 1996, IB; Wellcome site, Beckenham, TQ377676, 21.viii.2002, IB; on lawn, 47 Rectory Road, Beckenham, 1972, AR; Beckenham Cemetery, 1998, TQ353688, IB; Hayes Common, TQ400655, 1.xi.2000, and heather patch, TQ412650, 1998, IB; CAMDEN: Hampstead Cemetery, Fortune Green Road, 1972, PDC; CROYDON: West Norwood Cemetery, 2002, SD; HERTS: Spitalbrook, Lee Valley, 2005, BW; HOUNSLOW: abundant on sloping red brick wall near house, Osterley Park 12.vi.1971, BJC; ISLINGTON: Abney Park Cemetery; LAMBETH: one specimen fruiting in two tiers with cracked stem, on ground (contains fumarprotocetraric acid only TLC 460:9) Shakespeare Road, Brixton, SE24, 1984, Judy Lewis; MERTON: scarce on brick tomb, St Mary's churchyard, Wimbledon, 22.iv.1978, JRL; Wimbledon Common; RICHMOND: Rockery, Kew Gardens, 17.iv.1970 BJC; scarce, on bark of stump at base of *Populus* and in acid grassland, area between Richmond Coates and Bog Lodge, Richmond Park, 16.x.1987, JRL; 20th Century Garden, Hampton Court, 2002, SD; SOUTHWARK: Alleyn Playing-fields, Dulwich, 1978, FHB; SURREY: frequent, Headley Heath, 7.ix.1963, JRL; WALTHAM FOREST: Walthamstow St Mary; WESTMINSTER: Paddington Cemetery; one square-metre patch on compacted gravel path in grounds of Hanover Lodge, Bedford College, Regent's Park, 1974, J.P. Widgery. Sqs: 07, 08, 16, 17, 18, 26, 27, 28, 29, 36, 37, 38, 39, 46, 47, 48, 49, 56, 57, 58.

5. *Cladonia ciliata* var. *tenuis* (Flörke) Ahti (1977) {CR}

In Laundon under *Cladonia tenuis* (Flörke) Harm. (1907) but *C. ciliata* (as cited in Stirton, *Scott. Nat.* **9** (N.S. 3): 308, 1888) has been split into two subspecies, var. *ciliata* and **var. *tenuis***, the latter has usnic acid and is common in the south. It is the one treated here. Primary squamules disappear [*Cladina*]; podetia often with purple-brown tinge at apices, richly branched; orientated in one direction, branching dichotomous at apices. Apothecia brown, inconspicuous, rare. Pycnidial jelly red. P + r, K-, KC -, C-, UV -.

Ecology: Heaths. On acid soil amongst *Calluna*.

Historical records and Spitalbrook, Lee Valley Park, 2005, BW. This is a tentative identification but I believe it will be found in the London area so include it, although I would like to see a voucher specimen. Sqs: 47, 49.

6. *Cladonia coniocraea* (Flörke) Spreng. (1827)

Basal squamules are not dominant but can be large, finely divided and long. Podetia, arising from centre of squamule, dominant, < 2 cm, often curved, entirely sorediate, or corticated only few mm at base, if squamules on podetia only on lower part; apices mostly pointed and unbranched (cf. *subulata*) but if has small cup does not exceed width of podetium. Black pycnidia sometimes occur. Apothecia brown and rare. P + r, K-, C-, (fumarprotocetraric acid).

Ecology: Common, mostly on acid bark, less often on soil. Often occurs with *C. macilenta* which has a bluer tinge and K+ yellow reaction. SO_2 tolerant. Widespread and common. This is one of the commonest *Cladonia* in London.

Historical records plus **K(M)** 92441 Esher Common on rotten stumps, 5 xi.2000, MBAH; **K(M)** 76176 Banks of small pits, Hounslow Heath, 7. vii.1958. J.L. Gilbert, det. JRL 1958; **BM** 6813 Richmond Park; and BROMLEY: Hayes Common, TQ400655, 1.xii.2000, + heather patch, TQ412650, 1998, IB; Jubilee Country Park, vi.1993, IB; High Elms Estate, Bromley, 1998, IB; Down House,

TQ431612, 1.iii.1997, and St Mary's, Downe, TQ433617, 1990, IB; Sts Peter and Paul, Cudham, TQ445599, 1991, IB; Holy Trinity, Bromley Common,TQ423665, 1992, IB; Jubilee Country Park, TQ4368, IB; Burnt Ash Lane Cemetery, 20.vi.1992, IB; Bromley Hill Cemetery, 15.iii.1996, IB; All Saints, Orpington, TQ467665, 8.ii.1998, IB; Crofton Heath/Roundabout Wood, TQ4466, 6.iii.1990, IB; High Elms estate, TQ4462, IB; Burnt Ash Lane, TQ405107, IB; St Giles, Farnborough, Kent, TQ444643, IB; Bromley, Norsted, TQ4660, 2000, IB; City of London Cemetery, 1986; Halstead, 1998; Bromley Hill Cemetery, 1996, TQ393707, IB; on lawn 47 Rectory Road, Beckenham 1972, AR; CROYDON: West Norwood Cemetery, 2002, SD; GREENWICH: Oxleas Wood, on two stumps, March 1985, A.J. Harrington; HARINGEY: All Hallows Church and Cemetery, Tottenham; HOUNSLOW: abundant on sloping red brick wall near house, Osterley Park, 12.vi.1971. BJC; ISLINGTON: Gillespie Park, 2003; KENSINGTON & CHELSEA: West Brompton Cemetery; common and widespread, especially in enclosed cloister N. of Rotunda, on graves with kerbstones, Brompton Cemetery, 1975, FR; Chelsea Physic Garden, 2000, AA; MERTON: on peaty soil and *Calluna*, Wimbledon Common, 5.i.1992. FR; scarce on heath to east of windmill, 9.i.1994, Wimbledon Common, JRL; RICHMOND: Rockery, Kew Gardens 17.iv.1970 BJC; SUTTON: on *Salix fragilis*, 27.ix.1981, Beddington Sewage Farm, FHB; a few thalli at head of Farm Valley, Wimbledon Common, 24.x.1981, JRL. Sqs: 06, 08, 09, 16, 17, 18,19, 26, 27, 28, 29, 36, 37, 39, 46, 47, 48, 49, 56, 57, 59.

7. ***C. crispata* var. *cetrariiformis* (Delise ex Duby) Vain.** (1887)
The parent taxon is *Cladonia crispata* (Ach.) Flot. (1839) [in Wendt] but in Britain the var. *cetrariiformis* is more common, (var. *crispata* has more sturdy and squat podetia with shorter, subulate proliferations) and records to *C. crispata* refer to it.
Squamules small, indented, often disappearing (but not *Cladina*). Podetia are 2–6 cm tall, often dark, irregularly branched, terminating in cup-like structure of perforation surrounded by short spines, one of which prolifering to form additional podetia. Apothecia brown on terminal spines, rather frequent. Pycnidia brown, at apices of podetia, frequent. P-, K-, KC -, C-, UV + white (squamatic and barbatic acids).
Ecology: On mor amongst *Calluna*. Rare.
Historical and on edge of Spankers Hill Wood, on rotting stumps, Richmond Park, 1971, BJC. Sqs: 27, 46, 49.

8. ***Cladonia digitata* (L.) Hoffm.** (1796)
Podetia to 1 cm tall, often curved, pointed or with irregular cups which occasionally proliferate from margins, inside of cup corticated, otherwise entirely farinose-sorediate, with a few corticated patches towards the base. Basal squamules distinctive, rounded, to 1 cm, densely white farinose-sorediate on lower surface and on the upturned margins, often with orange tinge on lower surface towards point of attachment. Apothecia and pycnidia red, occasional, at ends of pointed apices or on short projections from margins of cups. Thallus P + orange-red, K + yellow, KC- C- (thamnolic acid).
Ecology: Habitat: rotting trees, humus and peat.
Host to *Chaenothecopsis parasitaster* (Bagl. & Carestia) D. Hawksw.
Historical and **K(M)** 124159 Esher Common, Round Hill on bark. 18.iv.2004. BMS and MBAH det. MBAH [? + *C. subulata* and *C. polydactyla*]; and West Norwood Cemetery, 2002, SD. Sqs: 08, 46, 49.

9. ***Cladonia diversa* Asperges** (1983)
Looks like a yellowish *C. pyxidata*, distinguished from *C. coccifera* and *C. pleurota* by narrow scyphi and densely micro-squamulose-granulose podetial surface. Stenroos (1989) gives a discussion of this complex but leaves it somewhat unresolved. I have therefore followed the *Flora* (Purvis et al. 1992). Red apothecia. KC+y, P-, UV-. Usnic acid and zeorin
Ecology: Acid soil, rotting trees, heathland. Local in open acid grassland and abandoned railway sidings.
Old records of *C. coccifera* are usually referable to this species, see Stenroos (1989). Feltham Marshalling Yard, Hounslow, 8.v.1992, JRL 3241 (herb. Laundon); Kew Gardens (as *C. coccifera*); frequent; Headley Heath, 7.ix.1963, JRL; several thalli amongst *Rumex*, Caesar's Camp area, Wimbledon Common 22.iv.1978, JRL; a few cups, at head of Farm valley, 24.x.1981, JRL; on peaty soil and *Calluna*, Wimbledon Common, 5.i.1992, FR; Hayes Common, heather patch, TQ412650, 1998, IB.
Sqs: 17, but see *coccifera* (36), also see *C. bellidiflora* (35).

10. *Cladonia fimbriata* (L.) Fr. (1831)

Squamules often small and inconspicuous. Podetia to 1.5 cm tall. Cups, 'golf tee' shape, not proliferating, farinose sorediate. P+ o-r, K-, KC-, C-, UV- (fumarprotocetraric acid).

Ecology: Recently disturbed sites, gardens and old walls, heathlands. Probably the most common *Cladonia* in London.

Historical records plus **K(M)** 76182 Hounslow Heath, J.L. Gilbert, 6.i.1957; **K(M)** 25673 East Sheen Common, 20.i.1957, coll. J.L. Gilbert, det. JRL, 1958; **K(M)** 76181 East Sheen Common, Surrey. JLG, 20.i.1957; **K(M)** 76180 On pathway near the tennis court, Kew Gardens, 23.xi.1958, JLG, det. JRL; **K(M)** NDB — Richmond Park, Surrey, Petersham Park, just S. of wall at N. end, on stump, det JRL 1960–4; **K(M)** 76183 Bank of old reservoir in Arboretum Yard, RBG Kew, 12.ii.1961, JLG, det. JRL 1961; **K(M)** 59799 Kew, Burlington Ave., 21.i.1968 coll. JLG det. JRL; **K(M)** 109455 Elmbridge, Esher Common on soil and mosses, 16.i.1994, JFS; **K(M)** 108950 Esher, West End Common (towards the Ledges) on mosses on *Salix*. BMS and MBAH det. MBAH. 2.ii.2003; **K(M)** 109324 Esher Common, on bark under *Calluna,* 9.iii. 2003 coll. BMS, det. MBAH; and BROMLEY: Hayes Common, heather patch, TQ412650, 1998, IB; 12 Winchester Place, Bromley, TQ396687, 29.i.2002, IB; Crystal Palace, Bromley, TQ3476, 3.xii.2000, IB; Down House, TQ431612, 1.iii.1997, IB; St John's churchyard, West Wickham, Kent, TQ389649, iii.1995, IB; Keston churchyard, TQ418629, 1990, IB ; St Mary the Virgin, Hayes, TQ405663, 1995, IB; St Giles, Farnborough, Kent, TQ444642, 1990, IB; St Nicholas, Chislehurst, Kent, TQ444699, 1990, IB; Chislehurst Catholic church, TQ443696, iii.1995, IB; Holy Trinity, Bromley Common, TQ423665, 1992, IB; St Luke's cemetery, Magpie Hall Lane, Bromley, TQ479640, 1993, IB; All Saints, Orpington, TQ467665, 15.iii.1996, IB; Chislehurst Cemetery, TQ454713, 1995, IB; London Lane Cemetery, Bromley, TQ398701, IB; Bromley Hill Cemetery, TQ393707, 15.iii.1996, IB; Beckenham Cemetery, TQ353688, 15.iii.1996, IB; St Luke's Cemetery, Magpie Hall Lane, TQ426671, 1993, IB; Burnt Ash Lane Cemetery, Bromley, TQ405707, 20.vi.1992, IB; Wellcome site, Beckenham, TQ377676, 21.viii.2002, IB; Cudham, SS Peter and Paul churchyard, 1988, TQ445599, IB; St Martin, Chelsfield, TQ479640, 4.iv.1998, IB; CAMDEN: Hampstead Heath, 2005; CROYDON: on wall of 39 Addiscombe Road, Croydon, 1971, N. Wallace; scarce on limestone and cement, South Metropolitan Cemetery, Norwood, 1977, JRL; West Norwood Cemetery 2002, SD; ESSEX: Essex Filter Beds, 2000; HARINGEY: E. Finchley Cemetery, TQ258897, 24.x.1988, K. Palmer; All Hallows Church and Cemetery, Tottenham; HERTS: Spitalbrook, Lee Valley Park, BW; HOUNSLOW: frequent on stony ground, 1991, Gunnersbury Triangle, Hounslow, JRL; Hounslow Heath, 2005, AW; ISLINGTON: Gillespie Park, 2003, AW; KENSINGTON AND CHELSEA: common and widespread, especially in enclosed cloisters north of Rotunda, on graves with kerbstones, Brompton Cemetery, 1976, FR; several thalli confined to moss cushions on mortar and brick, 14.ix.1990, Fulham Palace, JRL; West Brompton Cemetery; LAMBETH: on ground, Brixton, Shakespeare Road, SE24, 1984, Judy Lewis; MERTON: Wimbledon Common; scarce, at base of tomb 22.iv.1978, St Mary's churchyard, Wimbledon, JRL; on peaty soil and *Calluna*, Wimbledon Common, 5.i.1992, FR; RICHMOND: Richmond Park; Rockery, Kew Gardens 17.iv.1970, BJC; SURREY: Headley Heath, January 1955, JRL; SUTTON: a few thalli, on Hundred Acre Bridge, Beddington Sewage Farm, 6.ii.1982. JRL; WESTMINSTER: two plants on moss on rock, The Holme, Regent's Park, 1973, J.P. Widgery. Sqs: 07, 08, 16, 17, 18, 19, 26, 27, 28, 29, 36, 37, 39, 46, 47, 48, 49, 56, 57.

11. *C. floerkeana* (Fr.) Flörke (1828)

Squamules small, ofen tinged orange on lower surface. Podetia to 3 cm tall, corticated or partially decorticate, especially towards apices, frequently with coarse granules, or densely squamulose. Apothecia and pycnidia red on tips of podetia, single or clustered give it the name 'Bengal matches'. P-, K+ y or – (orange pigment K+ p), KC-, C-, UV- or blue (barbatic acid and, rarely, thamnolic acid).

Ecology: Heaths. On mor. Scarce.

Historical records and **K(M)** 76175 Hounslow Heath, JLG, 6.i.1957; **K(M)** 76191 Esher Common, grassy area on sandy soil near new A3, 22.xi.1981. BMS, det JFS; and frequent, Headley Heath, 7.ix.1963, JRL; Barnes Common, i.1971, T.W Ottley; on edge of Spankers Hill Wood, on rotting stumps, Richmond Park, 1971, BJC; a few podetia at head of Farm Valley, Wimbledon Common, 24.x.1981, JRL; scarce on heath to east of windmill, 9.i.1994, Wimbledon Common, JRL.; Hayes

Common, heather patch, TQ412650, 1998, IB; Spitalbrook, Lee Valley Park, BW. Sqs: 06, 09, 16, 17, 27, 38, 46, 47, 49, 57.

12. *Cladonia furcata* (Huds.) Schrad. (1794) **ssp. *furcata***
Squamules short, linear to rounded, somewhat dissected, soon disappearing (but not a *Cladina*). Podetia tall, abundantly dichotomously branched, corticate, smooth to areolate, a few squamules on podetia, forming tangled cushions, often torn and fissured, tips with branchlets; axils usually open. Apothecia brown, corymbose, often frequent. Can be confused with *C. rangiformis*, which prefers more basic habitats and has more divergent branching and raised green areoles on decorticate background. P + r, K- or y, KC-, C- (fumarprotocetraric acid, rarely traces of atranorin).
Ecology: Acidic, heaths, dunes, mossy rocks. Typical of grass heaths.
Historical records and **K(M)** 76179 Richmond Park, Surrey. 20.i.1957, JLG, 128 + 129; **K(M)** 76178 Kew Royal Botanic Gardens near the tennis court, 23.xi.1958, JLG; **K(M)** 68728 Esher Common (north) on sandy soil among short grasss. 20.vi.1994, JFS and BMS, det JFS; **K(M)** 106574 Esher Common on soil, 1.xii. 2002, BMS, det MBAH; **K(M)** 125228 Esher Common Round Hill in grass and soil. 15.ix.2004 MBAH; **K(M)** 125236 Esher, Fairmile Common, on soil. 19.ix.2004, BMS, det. MBAH; **K(M)** 125235 ditto HPLC.; **K(M)** 76184 Edge of grassy area near *Ulex*, sandy soil, near Esher, Surrey, W. edge of Esher Common near A3; and BROMLEY: Chislehurst Cemetery, 1995, TQ454713, IB; London Lane Cemetery, Bromley, TQ398701, 15.iii.1996, IB; St Giles, Farnborough, TQ444642, 1990, IB; Bromley Hill Cemetery, TQ393707, 15.iii.1996, IB; Hayes Common, heather patch, TQ412650, 1998, IB; HERTS: Spitalbrook, nr Broxbourne, BW; MERTON: two patches in grass heath, Caesar's Camp area, Wimbledon Common, 22.iv.1978, JRL; on peaty soil and *Calluna*, Wimbledon Common, 5.i.1992, FR; SURREY: scattered on Juniper Top, Box Hill, 2.iii.1963, JRL; occasional, Headley Heath, 7.ix.1963, JRL; RICHMOND: Barnes Common, vi.1971, T. W. Ottley; Wimbledon Common, two plants at head of Farm Valley, 24.x.1981, JRL; a few thalli in grass heath with *C. chlorophaea*, between Richmond Gate and Bog Lodge, Richmond Park, 16.x.1982, JRL. Sqs: 16, 17, 26, 27, 28, 36, 37, 38, 39, 46, 47, 48, 49, 56, 57.

C. furcata* ssp. *subrangiformis (Sandst.) Abbayes (1938), this is the current taxon but for records see under ***C. subrangiformis* (29).**

13. *Cladonia glauca* Flörke (1828)
Squamules small, elongate and incised. Podetia to 5 cm tall with pointed apices, mostly simple or up to 3 branches, with a longitudinal fissure and often open axils in branched specimens. Often densely squamulose in lower part and sorediate in upper part with a few scattered squamules. Apothecia brown, rare. Pycnidia brown, on apices, frequent. P -, K-, KC-, C-, Medulla UV + bluish white (squamatic acid).
Ecology: On rotting tree stumps and peat.
Host to *Epicladonia sandstedei* (Zopf) D. Hawksw.
Hayes Common, heather patch, TQ412650, 1998, IB. According to the *Atlas* this is under-recorded, I have therefore included it but would like to see a voucher. The UV reaction is useful. Sqs: 46, 56.

14. *Cladonia gracilis* (L.) Willd. (1787)
Squamules small, mostly disappearing. Podetia to 6 cm high, slender and often dark, mainly unbranched, pointed apices or shallow cup, often with dentate margin and sometimes proliferating from rim. Smooth corticated surface, squamules on podetia scarce. Apothecia, rare, and pycnidia, frequent, brown on apices. P+r, K-, KC-, C- (fumarprotocetraric acid).
Ecology: Sandy or acid soil, on rotting wood in heathland.
Historical record and Headley Heath, i.1955, JRL and 1997 (BLS). Voucher needed. Sqs: 28, 46.

15. *Cladonia humilis* (With.) J.R.Laundon (1984)
Squamules large, rounded, often forming a continuous crust. Podetia to 7 mm tall; cups not proliferating from rim, often subsessile, corticated at base, farinose sorediate above and in cup. Apothecia and pycnidia brown, rare, on cup edge. P + r, K+ y, KC -, C- (atranorin and fumarprotocetraric acid).
Ecology: Dry, sandy ground, especially recently disturbed; roadsides and surburban gardens.

Historical record 'Charlton and Woolwich in the London Borough of Greenwich' (type locality see Laundon (1984); and **SLBI:** (as *C. conista*) Footscray FB; and City of London Cemetery; West Brompton Cemetery, Kensington and Chelsea; Richmond Park, Richmond; Shakespeare Road, Brixton, SE24, 1984, Judy Lewis; London Lane Cemetery, Bromley, TQ398701, 15.iii.1996, IB; Chelsea Physic Garden, 2000, AA; Gunnersbury Cemetery 2002. Sqs: 16, 48, 57, 58.

16. ***Cladonia macilenta* Hoffm.** (1796)
Squamules small, indented, elongate. Podetia to 3 cm tall, often shorter, pointed without cups, usually farinose to coarsely granular-sorediate, rarely with squamules. Red apotheciaand pycnidia at tips, single or clustered, frequent. Greyer, with a bluish tinge, than *coniocraea*. P+ o, K+y, KC-, C-, UV- , (thamnolic, ± barbatic, and ± didymic acids).
Ecology: Acid humus soil, acid stone and decaying wood. Reasonably tolerant of SO_2 pollution and bark acidification.
Historical records and **K(M)** 92001 Ashtead Common NNR on old stump, 27.xi.1983, Coll. BMS, det. MBAH; **K(M)** 68727 Oxshott Heath, W. of station on soil and *Calluna*, 20.vi.1994, JFS and BMS.; **K(M)** 68726 Esher Common, S. of Black End, on rotten *Pinus* stump, 20.vi.1994, JFS and BMS; **K(M)** 110118 Esher, Oxshott Heath, by sandpit, on roots (exposed) *Pinus sylvestris,* 30.iii.2003. MBAH; **K(M)** 124999 Esher Common on bark, T Kokubun, 30.viii.2004, det. TK and MBAH; **K(M)** 125227 Esher Common, Round Hill, footbridge over A3 (near) on horizontal fence post, 5.ix.2004, MBAH; and Headley Heath, 7.ix.1963, JRL; near Sheen Gate, Richmond Park, i.1971, T.W. Ottley; Sanderstead, 1993; Kew Gardens; Hayes Common, heather patch, TQ412650, 1998, IB; Jubilee Country Park, Bromley, TQ4768, vi.1993, IB; Ruxley Gravel Pits, TQ474498, 10.x.1998, IB. Sqs: 08, 09, 16, 18, 19, 26, 27, 36, 38, 39, 46, 47, 49, 56, 57.

17. ***C. ochrochlora* Flörke** (1828)
Has more robust podetia than *C. coniocraea*. Corticated lower half and corticated in cup. Distinguish from *C. rei* by UV reaction [+ white in *rei*]. P+ r, K-, KC -, UV- (fumarprotocetraric acid).
K(M) 59757 Ruislip LNR on *Salix* wood,31.v. 1997, DLH; Hounslow Heath, 2005, AW, det. JRL. I have been unable to trace the first record and it is probably more common than these records show. Sqs: 16, 49.

18. ***Cladonia parasitica* (Hoffm.) Hoffm.** (1796)
Squamules narrow, numerous, dissected, often coralloid-branched and coarsely granular-sorediate. Podetia rare, irregular, often covered in small isidia-like granules and partly decorticate; fissured with gaping holes when well developed. Apothecia small dark brown on tip of podetia, mostly clustered. Pycnidia on squamules. P+ y, K+ y, KC-, C- (thamnolic and barbatic acids).
Ecology: On hard wood of *Quercus* and *Pinus*, locally frequent in ancient woodlands. [cf. *C. incrassata* and *C. squamosa*]
Historical records and **K(M)** 68715 Esher Common NE of Black Pond on *Pinus* log, JFS and LE Watts, det. JFS 20.xi.1995; **K(M)**130424 Theydon Bois, Epping Forest, AW 26.ii.2005. Sqs: 16, 56, 59.

19. ***Cladonia pocillum* (Ach.) Grognot** (1863)
Squamules more spreading than *C. pyxidata*, forming radiating rosettes. Podetia as in *C. pyxidata*. P+ r, K-, KC-, C-, UV- (fumarprotocetraric, ± atranorin).
Ecology: Calcareous stone. Posssibly a calcicole ecotype of *C. pyxidata*.
This species and *C. rangiformis* are chief hosts of *Diploschistes muscorum*. **BM** holds specimen of *D. muscorum* on *C. pocillum* from Hoe Street, Walthamstow.
Historical records. Frequent in virgin grassland, Box Hill, 1959, JRL; scarce, Banstead Downs, 13.i.1962, JRL and 17.vi.1964, JRL and T. Ahti. Sqs: 26, 46, 56.

20. ***Cladonia polydactyla* (Flörke) Spreng**. (1827) **var. *polydactyla***
Squamules small, incised, occasionally thinly sorediate below, with orange pigmented areas at base. Podetia sorediate, often with corticated granules and squamules below. Cups with proliferations from edge. Note *C. macilenta* which never has cups. Apothecia and pycnidia red at tip of podetia, single or clustered, frequent. Very variable. Very common. P + o, K + y, KC-, C-, UV-. (thamnolic acid).

Ecology: Acid-barked trees, wood, humus, soil, peat. Prefers high humidity. In polluted sites often grows with *C. coniocraea.*
Scarce, Headley Heath, 7.ix.1963, JRL; Bromley Hill Cemetery, TQ393707, 15.iii.1996, IB; Esher Common. Not all records traced. Sqs: 37, 46, 47, 49, 57.

21. ***Cladonia portentosa* (Dufour) Coem.** (1865)
Cladina. Podetia to 10 cm tall, grey-green with a yellow tinge, richly branched, oriented in all directions, branching predominantly trichotomous at apices, often with perforate axils. P-, K-, KC+ y or -, C-, UV + white in decorticate parts (perlatolic and ± usnic acids).
Ecology: Characteristic of heathlands, forming soft-looking cushions. Acid, nutrient-poor soils. Intolerant of too much shade and sensitive to nutrient enrichment and trampling. On Hampstead Heath it survives on heath transplanted from Thursley Common.
Historical records and **K(M)** 76190 Esher Common, viii.1981, PMK det. JFS; Hayes Common, heather patch, TQ412650, 1998, IB; Hampstead Heath, apparently established amongst *Calluna* 1972; Inner Circle, Regent's Park, A. Richards; abundant on Juniper Top, Box Hill, 2.iii.1963, JRL; occasional, Headley Heath, 7.ix.1963, JRL. Sqs: 16, 27, 28, 46, 47, 49.

22. ***Cladonia pyxidata* (L.) Hoffm.** (1796)
Squamules greyish green to olive or brown; tongue-shaped, thick, divided. Podetia goblet shaped (< 30 mm tall), tapering at base, with discontinuous cortex and occasional squamules; interior of cup with microsquamules and/or granular soredia, often short stalked with corticate granules, particularly well developed in cups. Cups can be bizarre shapes but rarely proliferating. Apothecia brown on proliferations at cup margins. Partially decorticate pale areas. No soredia. Apothecia, often short stalked, and pycnidia brown.
Ecology: Acid soil with little or no humus development, and acid and calcareous stone. Scarce.
Historical records: Hampstead Heath, T. Johnson; Tottenham, 1638; **K(M)** 110119 Esher, Oxshott Heath (by sandpit) on roots (exposed) *Pinus sylvestris,* MBAH, 30.iii. 2003; **K(M)** 109454 Elmbridge, Esher, common on soil and mosses, JFS, 16.i.1994; and common and widespread, especially in enclosed cloister north of Rotunda, on graves with kerbstones, Brompton Cemetery, 1976, FR; Hayes Common, heather patch, TQ412650, 1998, IB; Halstead 1998; London Lane Cemetery, Bromley, TQ398701, 15.iii.1996, IB; Burnt Ash Lane Cemetery, Bromley, TQ405707, 20.vi.1992, IB; Down House, TQ431612, 1.iii.1997, IB; Kew Gardens; Hill Garden, Hampstead; Wimbledon Common. Sqs: 06, 09, 16, 17, 26, 27, 28, 37, 39, 46, 47, 56.

23. ***Cladonia ramulosa* (With.) J.R.Laundon** (1984)
In Laundon (1970) as *C. pityrea* but his later researches on Withering led to the new name and type locality being found to be in London.
Squamules finely dissected, often isidioid-granular. Podetia with narrow cups, corticated or covered with isidioid or granular soredia, decorticate areas translucent. Cups tiny or flaring, sometimes proliferating from margin. Apothecia brown, often turgid, clustered on apices. P +red, K-, KC-, C- (fumarprotocetraric acid).
Ecology: Sandy heaths, moors, rotting tree stumps, fence posts, earth banks, wall tops and particularly thatch.
Host to *Epicladonia sandstedei* (Zopf) D. Hawksw.
Historical records: Described from 'Woolwich Heath in the London Borough of Greenwich' (Laundon 1984); London Lane Cemetery, Bromley, TQ398701, 15.iii.1996, IB; Hayes Common, heather patch, TQ412650, 1998, IB; Hampstead Heath, on transplanted heath from Thursley Common but persisting 2005. Sqs: 46, 47, 48.

24. ***Cladonia rangiformis* Hoffm.** (1796)
Basal squamules small, often absent. Podetia much branched, at wide angle, with pointed tips and usually closed axils. Neat dispersed islets of green algal cells on a white background. P- (P + r in 30% of collections), K+ y, KC-, C-. (usually with atranorin and rangiformic acids, more rarely also with fumarprotocetraric acid).
Ecology: Bare soil with little or no humus development.
Historical records and **K(M)** 106575 Esher Common on soil. 1.xii.2002 BMS det. MBAH; **K(M)** 68725 Esher Common (north) NE of bridge on sandy soil among

short grass. 20.vi.1994, JFS and BMS, det. JFS; and frequent in virgin grassland, Box Hill, 1959, JRL; City of London Cemetery; Barnes Common, Mary Clare Sheahan; London Lane Cemetery, Bromley, TQ395701, 15.iii.1996, IB. Sqs: 16, 28, 39, 46, 47, 48.

25. *Cladonia rei* Schaer. (1823)
Resembles *C. coniocraea*, occasionally with deformed cups. Also compare with *C. subulata*. P + slowly yellow-orange or -, K- C- UV + white (homosekikaic, and + fumarprotocetraric acids).
Ecology: Mineral workings and waste sites.
Frequent on stony ground, Hounslow, Gunnersbury Triangle, 1991, JRL [First record]; occasional amongst mosses in open acid grassland on abandoned railway sidings, Feltham Marshalling Yard, 8.v.1992, JRL3240 (herb. Laundon); railway embankment near Highgate Wood, OWP; Hounslow Heath. Sqs: 17, 27.

26. *C. scabriuscula* (Delise) Nyl. (1876)
Squamules disappearing. Podetia tall, slender, moderately branched, scabrid squamules, granular at tips; cups absent. Apothecia brown on apice of podetia, rare. Can be difficult to tell from *C. furcata* and *C. glauca* (UV+white).
Ecology: Known from moors and montane it is perhaps overlooked in urban situations.
K(M) 76193 with *Polytrichum juniperinum* in grassy area on sandy soil near new A3, Esher Common, 22.xi.1981 BMS, det. JFS; **K(M)** 76192 Edge of grassy area near *Ulex* on sandy soil, Nr Esher, W. edge of Esher Common near A3 bypass, 16.i.1994, BMS, det. JFS; **K(M)** 68724 Esher Common (north) on sandy soil among short grass, 20.vi.1994, JFS and BMS, det. JFS; and Chislehurst Cemetery, IB. Sqs: 16, 56.

27. *Cladonia squamosa* Hoffm. (1795) **var. *squamosa***
Basal squamules very incised, forming a dense mat but often disappearing early. Podetia pointed or small cups, centre becoming open and/or split near apex, covered in peeling squamules. No soredia. Apothecia and pycnidia brown. P-, K-, KC-, C-, UV+ (squamatic and ± barbatic acids).
Ecology: Very common on acid soils, peat and rotting wood, particularly in shelter situations.
K(M) 76171 Hounslow Heath, Middx, No.125, J.L. Gilbert, 6.i.1957; **K(M)** 76172 Richmond Park, No. 131, 20.i.1957; **K(M)** 110122 Esher, Oxshott Heath (by Sandy Lane car park) on trunk of *Quercus robur*, 30.iii.2003 BAH, KJH and HH, det. MBAH; and occasional, Headley Heath, 7.ix.1963, JRL; Chislehurst Cemetery, Bromley, TQ454713, 1995, IB; St Nicholas, Chislehurst, Bromley, IB. Sqs: 16, 17, 26, 28, 46, 47, 56, 57.

28. *Cladonia squamosa* var. *subsquamosa* (Nyl. ex Leight.) Vain. (1881)
More robust and densely squamulose. Possibly a chemotype as thamnolic and squamatic acids are closely related. P+o, K+ y, KC-, C-, UV- (thamnolic and ± barbatic acids)
Ecology: Similar to species.
K(M) 106573 Esher Common on soil, 1.xii.2002, coll. BMS, det. MBAH; and Hounslow Heath, 2005, AW, det. JRL.

29. *Cladonia subrangiformis* Sandst. (1924) — now ssp. of ***furcata*** (12)
A poorly understood species, possibly a morph deformed by excessive calcium oxalate production, an ecotype of *C. furcata*. In *Atlas* as species but in 2002 *Checklist* a ssp. of *C. furcata*. Raised white concretions frequently burst through shiny brown medulla; prostrate podetia gnarled and swollen with lateral spinules. P+ red, K- or faintly yellow (fumarprotocetraric acid and atranorin).
Ecology: On strongly calcareous lowland sites. In decline due to loss of chalk grasslands.
Frequent in grassland, Box Hill, 1959, JRL; scarce on bank, Banstead Downs, 18.xi.1961, JRL; abundant on chalk mound, Banstead Downs 13.i.1962, JRL, and 17.vi.1964, JRL and T. Ahti. No more modern records appear to exist so possible not still extant. Sqs: 08, 46, 56.

30. *Cladonia subulata* (L.) F. H. Wigg. (1780)
Squamules inconspicuous. Podetia tall, sometimes tinged brown, thin, with pointed apices; often irregularly branched or antler-like at apices; occasionally with irregular cups proliferating from margins; farinose-sorediate but sometimes corticated at base with a few squamules. P + r, K-, KC-, C-, UV- (fumarprotocetraric acid). Note: This is the type species for the genus.
Ecology: Well-drained sandy heathlands on acid soil but a modern record at Kew was on thatch (PWJ).
Host to *Epicladonia sandstedei* (Zopf) D. Hawksw.
Historical records: Dillenius from Enfield Chase (Laundon 1984); 'Cladonia furcata' Hill. 'Hampstead-heath produces abundance of it', Hill, J. (1751: 91–92); on peaty soil and *Calluna*, Wimbledon Common 5.i.1992 FR (specimen seen by JRL); and Kew Gardens, PWJ. Sqs: 16, 28, 56.

Extinct

31. *Cladonia caespiticia* (Pers.) Flörke (1827)
It has finely divided squamules which are K-, P+ o-r (fumarprotocetraric acid). Pycnidia on squamules. Apothecia frequent, sessile or on short, alga-free stalk. [cf. *C. parasitica* which is K + y, P + y (thamnolic acid) and has squamules which dissolve into coralloid-sorediate granules at the margins.]
Ecology: Acid humus soil. Unlikely to reoccur as ecological continuity has been broken. A species used in the New Index of Ecological Continuity (NIEC). After the Great Storm of October 1987 was found on banks on the Greensand outside the London area (IB).
Historical records. No modern records traced. Sqs: 38,49,58.

32. *Cladonia convoluta* (Lam.) Anders (1913)
Similar to *C. foliacea* but with larger squamules, and occasional black tufts of marginal hairs.
Ecology: On bare soil, sunny and base-rich, with little or no humus development.
Historical record only. Banstead Downs ex Herb. Forster [BM] Unlikely to be found today.

33. *Cladonia peziziformis* (With.) J.R.Laundon (1984)
Small squamules on bare acid soil with little or no humus development.
Historical records including type locality Hampstead Heath. Exinct there. Rare.

34. *Cladonia uncialis* ssp. *biuncialis* (Hoffm.) M. Choisy (1951)
A distinctive lichen with fairly robust podetia with dichotomously branched tips. P-, K-, KC+, UV+ (usnic and squamatic acids).
Note: *C. uncialis* ssp. *uncialis* is rare and occurs on sand dunes in north and north-eastern Scotland. It is more compact and ends in a star-shaped tip.
Ecology: On acid soil generally amongst *Calluna*. Open, acid heathlands, especially peat bogs, even waterlogged.
Host for *Bachmanniomyces uncialicola* (Zopf) D. Hawksw.
Only historical records. Sqs: 16, 28, 47. Modern records should have a voucher.

Excluded

35. *Cladonia bellidiflora* (Ach.) Schaer. (1823)
The true *C. bellidiflora* is a more northern species and although there have been verbal reports in the south I have failed to find a herbarium specimen. Any record for this species should be supported by a herbarium specimen.
K(M) 109323 Esher Common on soil and mosses. 9.iii.2003. Coll. BMS. Det. MBAH. Redet. JRL *C. diversa*.

36. *Cladonia coccifera* (L.) Willd. (1787) — see note and ***C. diversa*** (9).
According to the *Cladonia* fascicle (2) of the *Lichen Atlas of the British Isles* (Seaward 1996) *C. coccifera* s.s. is probably confined to the Scottish Highlands, thus our records should be referred to *C. diversa*. *C. coccifera* s.s. has flat or elevated areoles or irregular cortical plates with raised margins (scaly plates) and in *C. diversa* it has scaly plates, microsquamules and corticated granules. They are chemically similar.

P-, K-, KC+ yellow, C-, UV-. (usnic acid, zeorin and ± porphyrilic acid).
K(M) 108605 Chobham Common on sandy soil. EWB 19.i.2003 det. MBAH — probably referable to *C. diversa*. Sqs: 16, 17, 27, 36, 46, 47, 49, 57.

37. ***Cladonia foliacea* (Huds.) Willd.** (1787)
This species name has been used to cover any large *Cladonia* squamules and I cannot trace a valid record. It might arise from Dickson's *Lichen endivifolius*, which became *Cladonia foliacea* var. *endivifolia* (Dicks.) Schaer., now synonymized with *C. convoluta*. Sq: 49.

38. ***Cladonia strepsilis* (Ach.) Grognot** (1863)
Appears on *Atlas* square 16. From the square I was hoping to find it at Esher but no record has been traced, therefore it is excluded. This is a species that grows in poorly drained acid sites. The basal squamules are dominant, bronze-green with frequent brown pycnidia and a white undersurface. Podetia are rare, and it is easily told by the C + bright green reaction due to presence of strepselin, no other *Cladonia* has this reaction. More common in the north and west it is known also from the New Forest. Any record would need a voucher specimen.

39. ***Cladonia subcervicornis* (Vain.) Kernst.** (1900)
Larger basal squamules than *C. cervicornis* and other cushion-forming species and bluer colour. Squamules dominant, mostly erect and cushion-forming. Lower surface white, often blackened towards base. Squamulose podetia to 1.5 cm. with irregular cups which proliferate from centres or rims. Apothecia small, dark brown, on rim of cups, often clustered, frequent. P+ r, K+ y, KC-, C-. Fumarprotocetraric acid and atranorin.
Ecology: Mainly known from upland and coastal areas.
I have been unable to trace the source of the second record shown in the BLS *Atlas* but IB has since withdrawn her record for Hayes Common. A voucher specimen would be needed for a modern record. Sqs: 28, 46.

Note: 'Cladonia ramosissum solida' Hill = *Cetraria aculeata*.

Discussion

Laundon (1970) notes twelve taxa as extinct in his 16-km circle from Charing Cross, London — *C. arbuscula, C. caespiticia, C. peziziformis (*as *capitata), C. cervicornis, C. convoluta (*syn. *foliacea* var. *endivifolia), C.gracilis, C. ramulosa (pityrea), C. rangiformis, C. subulata, C. tenuis, C.uncialis, C. verticillata*, of which some taxa — *C. arbuscula, C. cervicornis* (including var. *verticillata), C. gracilis, C. ramulosa, C. rangiformis, C. subulata* are now rerecorded taking into account the larger area. The twelve he thought still extant were *C. bacillaris* (which has been synonymized with *C. macilenta*), *C. chlorophaea, C. coniocraea, C. crispata* var. *cetrariformis, C. fimbriata, C. floerkeana, C. furcata, C. portentosa* (as *impexa), C. pocillum and C. pyxidata.* Of my list of 39 taxa, covering a wider area, 2 were incorrectly identified (*bellidiflora, coccifera*); 3 others are exluded (*foliacea, strepsilis, subcervicornis*); 2 were historical and unlikely to reoccur (*peziziformis, convoluta)*; 3 historical ones could possibly reoccur (*caespiticia, subrangiformis,* and *uncialis* var. *biuncialis*); and of the remaining 29, 6 are relatively common — *chlorophaea, coniocraea, fimbriata, furcata, macilenta*, and *pyxidata* and 9 are almost common, *diversa, floerkeana, humilis, ochrochlora, pocillum, polydactyla, rangiformis, squamosa, squamosa* var. *subsquamosa*; and 13 are not so common — *arbuscula, cervicornis* s.l., *cervicornis* ssp. *verticillata, ciliata* var. *tenuis, crispata* var. *cetrariformis, digitata, glauca, gracilis, parasitica, portentosa, ramulosa, rei, scabriuscula*, and *subulata*. The current status of *C. arbuscula, C. crispata* var. *cetrariiformis*, C. *ciliata* var. *tenuis, C. glauca, C. gracilis* and *C. furcata* ssp. *subrangiformis* is uncertain although included in extant.

The succession of *Cladonia* on a site is related to many factors but especially the pH and competition from other organisims, such as plants that will

eventually shade them out. The nature of the substrate is obviously important — texture, humus, pH are all factors that will affect the distribution of *Cladonia*. Hur et al. (2004) looked at three species of *Cladonia* (*humilis, macilenta* and *ramulosa*) growing on coalmine waste dump soil in Korea and found that soil microbial enzyme activity was higher in lichen-colonized soil than in non-lichenized soil. Lichens take up heavy metal but they also appear to stimulate microbial activity as even a hot-water extract of lichen thalli had a beneficial effect on microbial activity. *Cladonia* is a difficult genus but I hope more records will be generated and we can achieve a more dynamic picture of their role in urban habitats. Lichen-rich heath usually has low soil productivity and therefore no significant grass. Old gappy heather allows light in and *Cladonia* is a particularly light-loving genus although *C. portentosa* is shade tolerant and a good competitor so is one of the most common on heath. Most are acidophiles but some are calciphiles such as *C. pocillum, C. furcata* ssp. *subrangiformis, C. rangiformis* and *C. convoluta*. *C. strepsilis* is found in wetter areas and so is *C. crispata*; drier areas favour *C. ciliata* var. *tenuis, C. arbuscula, C. uncialis, C. cervicornis* ssp. *verticillata, C. diversa, C. floerkeana, C. glauca, C. gracilis, C. macilenta* and *C. subulata*. Tree stumps are a good habitat to look for *C. coniocraea, C. ochrochlora, C. parasitica, C. caespiticia, C. fimbriata, C. floekeana,* and *C. digitata*.

This paper is an exercise in assessing records in the hope that more will be forthcoming, particularly as heathlands are being highlighted in 2006. The importance to biodiversity of old walls is also highlighted by the loss of *Cladonia*. The more people who are willing to send in records the more complete the picture will be.

A note on *Stereocaulon* Hoffm. (1796)

Hill's (1751) original *Cladonia* covered non cup-bearing species but included species now in *Stereocaulon, Sphaerophorus, Parmelia, Cetraria* and *Ramalina*. I have, therefore, decided to include *Stereocaulon* records in this paper; although the genus is not related to *Cladonia* it does have 'podetia' sometimes but these are solid. They have solid pseudopodetia and *Porpidia*-like asci and multiseptate spores. A genus that is frequent on metal-rich substrates and certain species seem to favour urban environments.

Four species have been recorded in London.

1. ***Stereocaulon dactylophyllum* Flörke**
   This was recorded from an imported boulder at Kew in 2005 but does not appeared to have survived in London and thus is no longer a valid record.

2. ***Stereocaulon nanodes* Tuck.**
   Damp metal-rich rocks and walls, by roads in urban areas.
   Historical records and BROMLEY: Beckenham, abundant on brick and mortar in Blakeney Road and locally abundant on brick in The Drive, and locally abundant on brick and mortar in Faversham Road, 1972, AR; Chislehurst Cemetery, TQ414713,1995, IB; Grove Park Cemetery, TQ416916, ii.1999, IB.

3. ***Stereocaulon pileatum* Ach.**
   Damp metal-rich areas.
   Historical records and CAMDEN: Golders Hill Park, West Heath Road, on brick garden wall of No. 229. A.R. Vickery No.117. CROYDON: 39 Addiscombe Road, on wall and adjacent walls, 1971, Miss N. Wallace. GREENWICH: Blackheath, 7 Pond Road, 1970, P.W. James (at the type locality of *Micarea leprosa*); REDBRIDGE: City of London Cemetery, 1991; RICHMOND: Kew Gardens, on brickwork of small pond, 17.iv.1970, BJC ; 3 Beauchamp Terrace, SW15, on rear wall, 1971 T.W. Ottley; Kew, Litchfield Road [?], 8.xi.1975, on brick wall-top in garden M.R.D. Seaward. WANDSWORTH: Putney Cemetery, on east wall, i.1971, T.W. Ottley. WESTMINSTER: Regent's Park, The Holme, one lichen, xii.1973, J. P. Widgery.

4. ***Stereocaulon vesuvianum* Pers. var. *vesuvianum***
Common in upland areas but also on man-made substrates.
CITY: several thalli on coping of brick wall at corner of Noble Street and Gresham Street, 27.x.1984, PEB. Phyllocladia sorediate with dark centres. [First record]

Stereocaulon vesuvianum* var. *symphycheileoides
BROMLEY: Biggin Hill Cemetery, TQ421593, 1989, IB; 12 Winchester Park, TQ454713, 29.i.2002, IB; REDBRIDGE: City of London Cemetery, 1991.

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Book review

Homo britannicus. The incredible story of human life in Britain. Chris Stringer. Allen Lane, 2006. 319 pp., large quarto, hardback. £25. ISBN 0 713 99795 8.

Chris Stringer has worked in the Palaeontology Department of the Natural History Museum since 1973, where he leads the research into human origins. He also directs the Ancient Human Occupation of Britain (AHOB) project, a collaboration of scientists and experts around the country, aimed at reconstructing the first detailed history of how and when Britain was occupied by early humans.

Homo britannicus tells us the epic history of life in Britain, from man's very first footsteps through to the present day. The author draws on the latest evidence and techniques of scientific investigation to reveal the incredible truth about the first Britons. On the way we are shown a Britain so tropical that people competed alongside lion, hippo, hyena and sabre-toothed tiger; then, it was cold enough to hunt reindeer and mammoth; and even colder still when our ancestors fled altogether as a wall of ice spread south across the country; then we look into the future.

We have been here long enough to live in one of the most stable periods of the last 500,000 years in terms of world climates, and this has allowed us to settle throughout most of the planet, apart from the polar regions, and to enjoy an astonishing growth from the few million people estimated for the end of the last ice age less than 13,000 years ago. The last ice age drove people out of Britain one last time, but also set the scene for the modern world by changing environments at a critical point in human history which resulted in agricultural revolutions in south-western and eastern Asia with the domestication of cereals and animals. Since the last ice age, there have been fluctuations during which the British grew grapes, or, as in the 1400s, average temperatures dropped and we had the Little Ice Age which lasted about 500 years and the Thames and the canals of Holland froze over. During the 1800s, Europe started to warm again heralding our present climatic era.

Over the past few years, the AHOB project, led by Chris Stringer, has made discoveries that have stunned the world, pushing back the date of man's arrival in Britain by a staggering 200,000 years. During the course of the book we visit Swanscombe, the Cheddar Gorge, Kirkdale Cave, Paviland, Kent's Cavern, Boxgrove, Hoxne, and many other important sites, including, of course(!), Piltdown.

This is not just the incredible story of our ancestors' battle for survival, it is a gripping detective story and an unprecedented investigative collaboration. *Homo britannicus* is essential reading for all those interested in human history and the story of the British landscape.

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Botanical records for 2005

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Abstract

This paper presents a selection of records of flowering plants and ferns made in the London Area in 2005. Novelties included are the first published British records of a fern *Doodia aspera*, a garden annual *Isotoma axillaris* and a house plant *Bryophyllum daigremontianum*, the first Middlesex record of *Fumaria capreolata*, the first and second Middlesex records since 1947 of *Erigeron annuus* and the first Kent and London Area record of *Dittrichia viscosa*. All the plants named were only of casual occurrence, with the exception of the *Dittrichia* which having reproduced itself in the wild can be said to be naturalized.

Introduction

This paper is part of an annual series in which I present the more interesting records of vascular plants made in the London Area, selected from those which have reached me. The London Area as here defined consists of an approximation to a circle of radius 32 km, centred on St Paul's Cathedral. The records are arranged according to the vice-counties used for the division of the British Isles into recording units by the Botanical Society of the British Isles (BSBI) and other scientific societies. In each vice-county (v.c.), records from London boroughs, with the name of the borough picked out in bold type, precede those from parts of the Area outside London, and the sequence of boroughs is roughly from the centre of London outwards. There are no records this year from V.C.19 or V.C.24.

There are many references below to the difficulty of deciding whether the occurrence of a plant in a given place is natural, or the result of deliberate human activity. The planting of native species, often done without the approval of the people responsible for the management of the site chosen, is certainly increasing. The writer's opinion of such plantings, especially in sites which were already of nature conservation interest without them, is that they are at best an irritation. Sites which are being managed for the sake of their rare species are devalued by plantings of the same species elsewhere, and sites which have large and attractive species introduced to them may well as a result suffer loss of natural biodiversity, which includes smaller and more vulnerable plants and animals.

V.C. 16, West Kent

The most central London borough in this vice-county is **Lewisham**. In a blackthorn thicket at Brockley Station, John Archer found a large plant of stinking hellebore *Helleborus foetidus*. This is both a rare British native species and a common plant in larger gardens, where it is favoured for its very early spring flowering; garden plants produce good seed, but as that has to remain in the soil undisturbed for almost a year before it germinates, casual plants are decidedly unusual. Near the borough boundary south of there, where there used to be a bridge over the railway, Nick Bertrand found *Lapsana communis* subsp. *intermedia*, the alien subspecies of nipplewort which before 2005 was recorded only from two London sites other than the well-known large colony on the Isle of Dogs, in one of which it had been deliberately introduced. Further south again, in the last remaining fragment of the Bell Green gasworks site, Mr Bertrand found common broomrape *Orobanche minor* and bee orchid *Ophrys apifera*. On a wall top in a very urban site at Deptford he saw flattened meadow-grass *Poa compressa* where it had reappeared some five years after having been cemented over, an indication of the very persistent rhizomes of

this species. In mid June he saw a plant of common spotted-orchid *Dactylorhiza fuchsii* which coincidentally I saw myself about a fortnight later. This was on the Hither Green Nature Reserve which has the best population in London of the true species *Brachypodium pinnatum* (the tor-grass usually seen in downland is *B. rupestre*, a stiffer plant with different leaf anatomy). Other plants I saw there were sheep's fescue *Festuca ovina*, a hawkweed *Hieracium trichocaulon* and the hybrid cinquefoil *Potentilla* × *mixta*, determined for me by Brenda Harold. On another site near the reserve I found naturalized Turkish iris *Iris orientalis*. On the west side of Prince Charles Road on Blackheath I saw five plants of wild clary *Salvia verbenaca*; surprisingly, there are no twentieth-century records of this species from Blackheath, which makes me uncertain whether it can be inferred that the plant has recently been introduced here. This was on a May day which I had spent mostly in **Greenwich**, starting from the Greenwich Peninsula Ecology Park, a pleasant spot whose plants include bottle sedge *Carex rostrata* which was certainly introduced here; this species has not been correctly recorded from London for centuries, the reference to it in Fishpond Wood, Merton, in *Wild London*'s Spring 2004 issue being an error, as the rare sedge there is bladder sedge *C. vesicaria*. I went on to look at the clustered clover *Trifolium glomeratum* in front of Charlton House where it was discovered by Jon Riley in 2002, and found that bird's-foot clover *T. ornithopodioides* was also present in another part of the lawn. On a rugby pitch behind the house I found a few plants of dark green mouse-ear *Cerastium diffusum* which like the other small mouse-ears is perhaps often overlooked. Later in the year I made a passing visit to the grounds of the former Royal Naval College, finding one plant of the increasing narrow-leaved ragwort *Senecio inaequidens* and one of common storksbill *Erodium cicutarium*. The latter was a very glandular plant with small flowers, resembling the much rarer sticky storksbill *E. lebelii*, but the crucial fruit details were those of *E. cicutarium*; this I think sheds some light on the record of *E. lebelii* from Green Street Green near Dartford in 2004, for which no fruit details were supplied. Also in Greenwich, Mr Bertrand told me about the colony of bee orchids near the Thames Barrier, over thirty of them in 2005, first found by Louisa Lemarchand in 2001.

Wild clary was also conspicuous on the walk from Barnes Cray to Crossness in **Bexley** at our meeting on 6 August, together with musk mallow *Malva moschata*, and again neither of these was present until a few years ago. Perhaps their arrival had some connection with the Environment Agency's management of the banks of the tidal rivers, like the burning of the vegetation which has done nothing to stop the spread of reeds *Phragmites australis* on the mud, which have overwhelmed the patch of marsh sow-thistle *Sonchus palustris*, known here for about forty years since first found by Joan and Peter Hall in 1963. The most unexpected find on this walk was a single plant of rough poppy *Papaver hybridum* in a shrubbery by Thames Road. More centrally in Erith, I should mention Margot Godfrey's dense-flowered fumitory *Fumaria densiflora* in flower on the early date of 11 February in Ramsden Road. John Palmer found Italian garlic *Allium pendulinum* in woodland at Barnehurst. I found an additional locality for rue-leaved saxifrage *Saxifraga tridactylites* in **Bromley** going into the Sydney Arms near Scadbury Park from its car park. Scadbury Park was one of seven new sites in the borough for corky-fruited water-dropwort *Oenanthe pimpinelloides* found by Joyce Pitt, the others being Hayes Common, Keston Common, Ravensbourne Meadows, a meadow at High Elms, West Wickham Common, and grass below the wood at Spring Park; the plant occurs wherever grass has been mown, and is evidently somehow being spread on contractors' machines moving from site to site. Ian Kitching supplied some records from Elmers End Cemetery. Grey sedge *Carex divulsa* is abundant throughout and spiked sedge *C. spicata* also occurs, and there were also casual plants of Balkan spurge *Euphorbia oblongata* and small melilot *Melilotus indicus*.

Moving out of London, the most interesting record from **Kent** in 2005 is the new species for the vice-county and for our area, woody fleabane *Dittrichia viscosa*. Geoffrey Kitchener found a large well-established plant of it, with three seedlings nearby, on the south bank of the A2 at Pepper Hill, in the course of an investigation into the distribution in Kent of summer-cypress *Bassia scoparia*, prompted by my report of it outside our area by the M20 in the previous year. All the *Bassia* in our area found by him was near the A2, with four plants by a slip road on Dartford Heath but many more a lot farther east near Bean and Pepper Hill. Full details are in his paper (Kitchener 2006). There are single records of this species in our area by the M25 in Herts. and the A3 in Surrey, but further searching late in the season might show that it has become more abundant in this habitat. In woodland east of the railway near Polhill, Mr Kitchener found a patch with very abundant twayblade *Listera ovata* forming the principal ground vegetation, and a group of nine spikes of bird's-nest orchid *Neottia nidus-avis*. Mrs Godfrey found well-established many-flowered rose *Rosa multiflora* scrambling over trees in Joyden's Wood.

V.C. 17, Surrey

Nick Bertrand sent me a large number of interesting records from inner London sites south of the Thames in 2005. In Webber Row in **Southwark**, as well as the usual street weeds *Antirrhinum*, *Lobelia*, *Lobularia*, *Petunia* and *Persicaria capitata*, there was an annual which he had difficulty identifying, as I would have done if I had not selected a seed packet from a catalogue during the winter. This was *Isotoma axillaris* Lindley, a close relative of *Lobelia*, which has not been recorded wild in Britain before, though Eric Clement tells me he has once seen it self-sown in South Hants; the name on my packet is *Laurentia auxillaris* (sic) 'Fantasy Blue'. Lowth Road was unexpectedly rich in ferns, with *Asplenium adiantum-nigrum*, *A. ruta-muraria*, *A. trichomanes* and a *Polypodium* on a low wall and a large colony of rusty-back *Ceterach officinarum* on a free-standing brick bin holder. Silver hair-grass *Aira caryophyllea* came from brick steps near the bowling green in Ruskin Park. Many of Mr Bertrand's records are of tree species. He reckons the commonest wild tree in south London to be tree-of-heaven *Ailanthus altissima*, but he also recorded colonizing black walnut *Juglans nigra* in a hedge round a nursery at Guy's Hospital, the parent being behind houses across the road, a self-sown *Catalpa bignonioides* in a grilled gutter in Pilgrimage Street and several saplings of pride of India *Koelreuteria paniculata* in Warner Road. The Surrey Docks were rewarding in respect of their ferns, including house holly fern *Cyrtomium falcatum* and ribbon fern *Pteris cretica* on vertical walls of the South Dock. A piece of waste ground near Canada Water bus station had the great surprise of two strong plants of woad *Isatis tinctoria*. On my way to look at this following Mr Bertrand's photographic instructions, I noticed a tree of the commonly planted cut-leaved elder *Sambucus nigra* var. *laciniata* at the edge of Canada Water, and also next to it another tree half its size which was clearly a natural hybrid with a normal elder. In other parts of Southwark, David Bevan and Mark Spencer independently noted a plant of tall nightshade *Solanum chenopodioides* on the Queen's Walk near HMS *Belfast*, and Richard Robinson found *Adiantum raddianum* on old brickwork at North Dulwich Station, our first record of this fern from London south of the Thames. Mr Bertrand has also been busy in **Lambeth**. On the Millennium Green in Waterloo Road he found two plants of thorn-apple *Datura stramonium* among the planted subjects, which included hemp agrimony *Eupatorium cannabinum*, purple loosestrife *Lythrum salicaria*, pale galingale *Cyperus eragrostis* and Argentinian vervain *Verbena bonariensis*, offspring of which he found as street weeds nearby in Coral Street. Other Lambeth plants of his are blue passion-flower *Passiflora caerulea* in Emery Street and water chickweed *Myosoton aquaticum* at Vauxhall roundabout, 'and why not?'. None of those has any pretension to be a native plant in Lambeth,

but it is just possible that hairy buttercup *Ranunculus sardous* in thin turf near the south-west entrance to Brockwell Park could have such a claim; this was found by Luke Bristow in the course of a survey for Land Use Consultants. Finally in this borough, Ian Kitching saw from a train a large group of plants of shining cranesbill *Geranium lucidum* between the railway tracks going through Lambeth. In similar circumstances between Wimbledon and Earlsfield stations Dr Kitching saw rue-leaved saxifrage, the first modern record of this species from **Merton**. A curious record of his from Morden Hall Park is the lungwort cultivar *Pulmonaria* 'Blue Ensign' apparently naturalized on the river bank; the name was taken from labels in the pots sold in the nearby garden centre, and it may never be known whether the river bank plants were cunningly put there by staff.

A few plants in **Richmond upon Thames** seen at our meeting of 4 September should be mentioned. On hard standing on the Thames shore in front of the old Harrods Repository, there were plants of common fleabane *Pulicaria dysenterica* which used not to be there a few years ago; it was suggested that these were self-sown from planted stock in the Wetland Centre about 200 metres away. On the bank of the Lonsdale Road Reservoir, a well-known locality for dark mullein, there was a single plant of its hybrid with common mullein, *Verbascum* × *semialbum*. On the river wall at Mortlake there was a plant of *Fatsia japonica* about eight metres from its parent in a garden. Earlier, when preparing for this meeting, George Hounsome and Mary Clare Sheahan had seen a self-sown cabbage-palm *Cordyline australis* on the Thames bank just south of the end of Queen Elizabeth Walk. Moving out into what is still **Surrey**, Sarah Longrigg told me of a presumably monstrous plant of cowslip *Primula veris* 'with flowers arranged as in *P. denticulata*', i.e. facing in all directions so that the umbel is globose. It was pleasing to read in a Plantlife report that dredging the pond on Littleworth Common has been followed by the reappearance of orange foxtail *Alopecurus aequalis* and small water-pepper *Persicaria minor*.

V.C. 18, South Essex

Jon Riley sent me for confirmation material of early meadow-grass *Poa infirma* which he had found growing densely on sour-looking compacted soil between the Northern Relief Road and Cowbridge Lane in Barking, **Barking and Dagenham**; fragments of lesser chickweed *Stellaria pallida* were mixed with it. In the same borough, Mark Spencer and Fred Rumsey were lucky to find divided sedge *Carex divisa* persisting among *Agrostis* under a light covering of birch on the Ripple Nature Reserve. Moving out to **Havering**, Ken Adams sent me a correction to the report of hawkweeds west of Hacton Lane, Upminster in last year's records (Burton 2005: 221). *Hieracium vagum* and *H. sabaudum* are abundant, there are three or four plants of *H. salticola*, but *H. virgultorum* is absent. Dr Adams confirmed that two patches of opposite-leaved golden-saxifrage *Chrysosplenium oppositifolium* survive in Bower Wood, which has carpets of bluebells and anemones and also a large population of daffodil *Narcissus pseudonarcissus*, which could well be native here. Mary Smith continued to send me details of plants added to the flora of TQ58 by herself and others. Her own contributions include two fescues, *Festuca brevipila* on the verge of Pike Lane, Cranham and *F. heterophylla* in secondary woodland round the edges of the slope by Hacton Lane already mentioned, and a hawkweed, *Hieracium scotostictum* in some quantity at Strawberry Farm, Hall Lane, Upminster. Bob Creber found a mature plant of short-styled field-rose *Rosa stylosa* in the south-west corner of the wood at the east end of Rayburn Road, Hornchurch and Pete Tomlins five plants of sweet cicely *Myrrhis odorata* on an allotment near Roneo Corner. TQ58 extends over the boundary of the unitary authority of **Thurrock**, and on a gravelly path within a yard or two of that

boundary Mrs Smith saw a single plant of toothed medick *Medicago polymorpha*. On waste ground on poor soil on Davy Down she found slender soft-brome *Bromus lepidus*, close to a three-metre patch of spring vetch *Vicia lathyroides* spotted by Barbara Williams at the Essex Field Club meeting on 11 May. The only record from the remainder of **Essex** in our area to be referred to here concerns the marsh lousewort *Pedicularis palustris* heralded as an important return from long-buried seed on the restored heathland of Almshouse Plain, Epping Forest in the published report of our meeting of 17 July; the plant seen was in fact *P. sylvatica*, a good find but already known from this site.

V.C. 20, Herts.

As last year (Burton 2005: 222) the only records from this county I am going to mention come from the field on Barley-Mo Farm conserved originally for its wealth of cornflowers, which was visited by our meeting on 11 June and again by its leader David Bevan a month later. By far the most important of the additional finds was spreading hedge-parsley *Torilis arvensis*, about 150 plants in three places; only one more substantial population has been found in our area in the last thirty years. Other new plants for the site were singletons of *Aira caryophyllea* and wild pansy *Viola tricolor*, and bee orchid reported to me separately by Dr Kitching.

V.C. 21, Middlesex

The plant of *Polystichum tsus-simense* (Hooker) J. Smith found by Richard Robinson on the wall of a basement area in Glentworth Street, Marylebone in the **City of Westminster** is apparently the first record of this fern outside cultivation in the British Isles; the photograph of it in our *Newsletter* No.195 is excellent evidence of its correct identification. Wild clary, already mentioned twice, appeared again at our joint meeting with the Wild Flower Society on 23 April on the canal path in Mile End,**Tower Hamlets**, where it was considered to be of debatable origin — what then of bur parsley *Anthriscus caucalis* in the same place and the non-native species *Barbarea intermedia* nearby? At this meeting Dr Kitching identified little mouse-ear *Cerastium semidecandrum*. Ron Parker's report from Tower Hamlets Cemetery specifically mentions small teasel *Dipsacus pilosus*, sainfoin *Onobrychis viciifolia* and corn buttercup *Ranunculus arvensis* as having spread out of the compartments in which they were sown. John Swindells who led this meeting also found a population of *Poa infirma* in his home borough, from the back of the south side of Roman Road market, and later in the year showed me a specimen of tall fleabane *Erigeron annuus* from the Limehouse Cut where it had been found by Prof. Robinson; this species, which had not been seen in Middlesex since 1947, is a native of North America and is widely naturalized in Continental Europe, where it is regarded as having been originally an escape from garden cultivation, though it is not particularly ornamental. Mr Swindells and Prof. Robinson together saw shining pondweed *Potamogeton lucens*, which I had feared lost from London's canal system, in the Hertford Union Canal. Another new alien fern for the British flora is *Doodia aspera* R. Brown, which John Edgington found in the basement area of the Russell Hotel in **Camden**; his photograph of the plant appeared in *BSBI News* No. 100, but by the time that was published the fern had already succumbed in the clean-up operation after the nearby bus bomb outrage on 7 July. Aaron Woods and Roy Maycock found four plants of kangaroo-apple *Solanum laciniatum* in three places near the Grays Inn Road, a triumph of identification as none was in flower; Prof. Edgington tells me that the source of these is planted in Mecklenburgh Gardens. Another find of theirs was a cluster of plants of nettle-leaved goosefoot *Chenopodium murale* in Albert Street, Camden Town, hopefully a replacement for the well-known population near Conway Hall which seems finally to have perished. Aaron alone found

single plants of cut-leaved deadnettle *Lamium hybridum* by a path in Ampthill Square and *Bryophyllum daigremontianum* A. Berger in a roof-gutter in Gordon Street; the latter, another new plant for the wild in Britain, is a tender succulent from Madagascar unlikely to flourish outdoors in Britain, but grown indoors as a curiosity because of its habit of producing numbers of miniature plants from the margins of the leaves — indeed the Gordon Street plant had several 'pups' beside it. The only **Islington** record to mention is Mark Spencer's white ramping fumitory *Fumaria capreolata* lightening up a cold dark corner of Margery Street, from which it was soon gardened away; the only previous Middlesex records attached to this name pre-date Pugsley's 1919 monograph of *Fumaria*, and probably refer to other species. As a **Haringey** record, I offer as a contribution to my theme the three obviously new plants of soft shield-fern *Polystichum setiferum* in Coldfall Wood, seen at our meeting of 23 October.

Ealing has many more noteworthy records because John O'Reilly made available to me the records he made, occasionally with others, including Clare Coleman, now Mrs O'Reilly, for a GLA-funded survey of the borough's habitats. Near Southall Station he found *Erigeron annuus*, already mentioned in the previous paragraph. We wait almost sixty years for another plant of it to turn up, and then two come along. Near Dormer's Wells there was a cardoon plant *Cynara cardunculus*, the third in the wild in London and Middlesex and the first in Ealing. All the following appear to be new species for the borough: water fern *Azolla filiculoides*, blue-fruited water-starwort *Callitriche obtusangula*, giant scabious *Cephalaria gigantea*, pampas grass *Cortaderia selloana*, blue globe-thistle *Echinops bannaticus*, Californian poppy *Eschscholzia californica*, Montpellier broom *Genista monspessulana*, bulbous rush *Juncus bulbosus*, curly waterweed *Lagarosiphon major*, the alien subspecies of nipplewort *Lapsana communis* subsp. *intermedia*, the garden tree-mallow *Lavatera* × *clementii*, fly honeysuckle *Lonicera xylosteum*, love-in-a-mist *Nigella damascena*, wild marjoram *Origanum vulgare*, small pondweed *Potamogeton berchtoldii*, hybrid cinquefoil *Potentilla* × *mixta*, narrow-fruited water-cress *Rorippa microphylla*, *Senecio inaequidens*, Argentinian vervain *Verbena bonariensis* and wayfaring-tree *Viburnum lantana*. My predecessor as BSBI recorder for Middlesex, D.H. Kent, lived all his life in Ealing and it is not unlikely that all of these are genuine arrivals since his death in 1998. The habitat for almost all the aquatic plants listed is park ponds (one of the two *Juncus bulbosus* sites is on Horsenden Hill) and the *Origanum* and *Viburnum* are almost certain to be planted. A native plant new to Ealing which may well have found its own way there is ivy broomrape *Orobanche hederae*, of which Pamela Simpson found thirty-two shoots in Avenue Road, Southall. Mr O'Reilly also found common broomrape *O. minor* in a shrubbery at **Brent** council offices.

From **Hillingdon** Gordon Tranter sent me an update on two plants which Ian Johnson reported in 1995 as probably having been introduced by the National Rivers Authority on Ickenham Green. *Geum rivale* has gone down from three clumps to a single plant but *Thalictrum flavum* is increasing. Mr Tranter also mentions ragged-Robin *Lychnis flos-cuculi* as present, which Mr Johnson didn't, but surely its history is similar. On **Hounslow** Heath our meeting of 4 June saw dozens of bee orchids in a meadow area, yet another unexpected increase of range. In the same borough, Clare Coleman got her record of *Callitriche obtusangula* in the Gunnersbury Triangle confirmed by sending a microphotograph of the plant's pollen to the referee. A more surprising orchid record is the single plant of green-winged orchid *Orchis morio* in a field previously grazed by horses, not accessible to the public, in Bushy Park in **Richmond upon Thames**; this was sent to me by Pippa Hyde, not the original finder, but Miss Hyde tells me that the plant was devoured by Canada geese soon after. She led our meeting of 28 May which located a good selection of the rarities of Hampton Court Park in flower on that date; this is mentioned

for the sake of the annual pearlwort *Sagina apetala* which Dr Kitching found to be a good match for the segregate called *S. filicaulis*, the worth of which is disputed. On his way to or from the meeting at Hampton Wick, he found Danish scurvygrass *Cochlearia danica* at the base of a lamp post and three good-sized saplings of foxglove-tree *Paulownia tomentosa* round the edges of a car park. On 19 June a Wild Flower Society party, also led by Miss Hyde, found a previously overlooked plant of bee orchid by the cycle path running parallel to the Barge Walk. Last year (Burton 2005: 223) I reported having looked for tower mustard *Arabis glabra* at Stain Hill Reservoirs with Miss Hyde and her mother in 2004 (not 2005 as there stated) and finding only one plant. We had walked all the way round the bank surrounding the two reservoirs and had neglected to explore the strip of land between them — in 2005 Dr Spencer and Fred Rumsey found about 300 plants of this rarity, and what is more maybe 10,000 plants of ivy broomrape on the north side of Upper Sunbury Road, an astonishing discovery.

The most important site in that part of the vice-county which is now administratively in **Surrey** is Shortwood Pond with its marginal population of brown galingale *Cyperus fuscus*, which is being monitored by Barry Phillips. In 2005 he found only ten plants, being swamped by the very invasive New Zealand pigmyweed *Crassula helmsii*, against which battle has been raged for many years. Also in the pond there were forty or more plants of water lettuce *Pistia stratiotes* and ten of water hyacinth *Eichhornia crassipes*, large floating aliens which can increase in number vegetatively in a warm summer but cannot yet survive our winter. Somebody must have brought these plants here, either to get rid of them, in which case the dustbin would have done just as well, or to enhance the pond; I wish they wouldn't. The marsh at the west end of the pond is the last remaining Middlesex site for fine-leaved water-dropwort *Oenanthe aquatica*, and it is good that Plantlife's clearance work has resulted in an increase of its population size. I spent a day in early August in the Shepperton area, finding some of its more distinctive plants, such as fiddle dock *Rumex pulcher* and meadow cranesbill *Geranium pratense*. Rue-leaved saxifrage is still present on walls at the Warren Lodge Hotel, but no longer abundant on roofs and gutters as it was when Kent saw it in 1966, but when he was there it was not possible to see floating pennywort *Hydrocotyle ranunculoides* in the Thames there as it is now.

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Book review

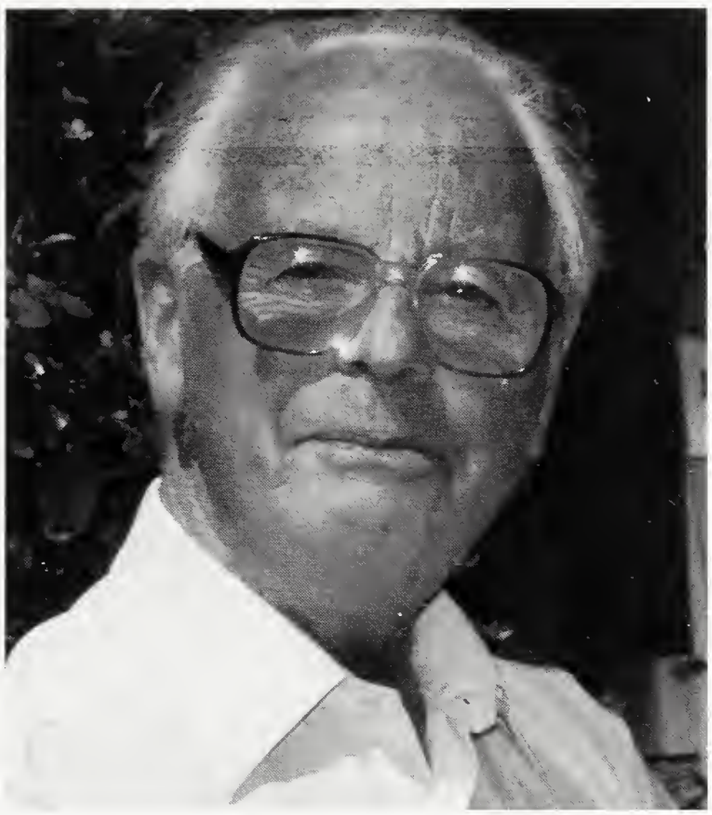
The Aurelian's fireside companion: An entomological anthology. Michael A. Salmon and Peter J. Edwards. 428 pp., plus 8 pages of colour plates, numerous black and white photographs and original drawings by Tim Bernhard. 282 × 217 mm., hardbound. Paphia Publishing, 2005. £35. ISBN 0 9537236 1 5.

Printed in a limited edition of one thousand numbered copies, this book is both entertaining and informative, combining these two aspects seamlessly and creating the perfect companion to *The Aurelian Legacy*, by Michael Salmon, published by Harley Books in 2000.

This is a book to read, not one to read about. After a Foreword, various credits and acknowledgements, a Preface and then a Prologue, seven chapters follow with the intriguing titles of 'The Curious case of Albin's Hampstead Eye', 'Noctes Ambrosianae — light traps and sugar', 'I'll see you in Hell — an afternoon near Oxford', 'Five miles from anywhere — butterfly hunting in the British Isles', 'Travellers' tales — butterfly hunting overseas', 'Well Mr Holmes, what do you make of these? — a cabinet of entomological curiosities', and finally 'Some gentlemen of the net — and a Rannoch Sprawler'. Within each are to be found many separately headed texts covering a whole array of matters from anecdotal tales, biographies and all sorts. There is a wonderful repetition of an 1858 article in the *Entomologist's Weekly Intelligencer* decrying the high cost of postage to send insect specimens; then there is a series of four ancient monochromes depicting 'Style and Costume' amongst four 'gentlemen of the net'. No two items are the same — the authors are to be congratulated for their diligence and skill is selecting and bringing together such a disparate array of material from such a phenomenally wide range of sources and combining it into a single work such that it flows logically and makes great sense to the reader. This is a book to dip into on a regular basis — keep it on the bedside table, in the lounge or even in the loo, but make sure that when the opportunity arises to spend a couple of minutes reading this is the first book that you pick up.

COLIN W. PLANT

Obituary



RICHARD FITTER, FLS, FZS, MBOU, 1913–2005

Richard Fitter died on 3 September 2005 aged 93, and three national newspapers carried obituaries to him: *The Independent* (5 September), *The Daily Telegraph* (6 September) and *The Times* (10 September). This is not surprising as Richard was among the best known natural history writers of the twentieth century, with a writing career spanning over sixty years.

Other obituaries have documented the nuts and bolts of his life but Richard was a naturalist first and foremost, and a career as a natural history writer enabled him to indulge his passion. His major passion as a naturalist was with London and one of the first volumes to be published in the Collins New Naturalist series was *London's Natural History,* published in 1945. This was a truly groundbreaking work, coming at the end of the Second World War when central London was seeing wildlife re-establish itself in the ruins and rubble. This was followed in 1949 by *London's Birds*, and then in 1952 the first of his numerous field guides. I recall visiting the London bomb sites in the Cripplegate area in the early 1950s when it was still the breeding ground for black redstarts, and the ruins were still covered in wildflowers, just as described by Richard, and of course his *Pocket Guide to British Birds* was the only useable guide at that time.

I first worked with Richard in 1975, when I joined the (then) Fauna Preservation Society as Assistant Secretary, when Richard was Honorary Secretary. The offices of the FPS were inside London Zoo (next to the wolves), and at lunchtimes Richard and I would walk around and, as might be expected, take more interest in the herons and gulls breeding on top of the aviaries than the birds inside. I also recall Richard spotting a plant growing in a crack in the yard outside our office and commenting that this must have arrived in my car tyre as it was from East Anglia and not normally found in London. To my regret, I do not recall the species. Richard was one of the last truly general naturalists, and I always envied his botanical knowledge. After I moved from London to Suffolk his annual visit was always an opportunity to add to the list of wildflowers in our garden. As author of definitive field guides to birds and flowers which remained in print for about half a century, his influence on future generations is immeasurable.

To someone meeting him for the first time, Richard was rather distant and almost other-wordly and old fashioned, but the reality was very different. Although he had a reputation for being serious, he had a well-developed sense of humour, which was only revealed after long acquaintance. He was also surprisingly liberalistic in his views, though with little time for party politics or politicians. However, as a deeply committed conservationist, Richard was well aware of the importance of working with politicians, and Lord (Jack) Craigton was a good friend of Richard and used his influence extensively on behalf of conservation. For the latter part of his life Richard was deeply involved with international conservation, but he always remained, at heart, the classic English naturalist in the tradition of Gilbert White and his successors, as a glance at his published oevre will demonstrate. Out of over forty books he authored, only three deal with international aspects of wildlife, although his knowledge of international wildlife, and in particular conservation issues, was encyclopaedic. There are very few naturalists or conservationists who could fill the gap he has left behind.

JOHN A. BURTON

Richard Sidney Richmond Fitter, the son of Sidney and Dorothy Fitter, was born in south London on 1 March 1913. He was educated at Eastbourne College and then at the London School of Economics where he graduated. In 1934, when living in Ewell, Surrey he joined the London Natural History Society 'and my fate was finally sealed'. The membership list for that year gives his interest as ornithology. By 1936 he had added ecology and entomology, while later lists show that he had added botany. It is as an all-round naturalist that we remember him.

In no time at all Richard had immersed himself in our activities. He recalled that in 1935, on being appointed secretary to the Ornithology Section, he had distinguished himself by forgetting to bring the minute book for his first committee meeting, but the chairman, Cynthia Longfield, had been kind to him. In his first paper in *The London Naturalist* (*No. 16*, 1937), he described the starling roosts in north-east Surrey. In 1938 he joined Council. Further papers from him appeared regularly in the *LN*, and in *No. 27* (1948) and *No. 32* (1953) appeared his valuable two-part 'Contributions to the bibliography of the natural history of the London area'.

He began his professional life as a social scientist, working on the research staff of the Institute for Political and Economic Planning, and, during the early war years, for Mass Observation. In 1942 he joined the Operational Research Section of Coastal Command, but in the evenings he devoted his time to natural history. It was during the Second World War that Richard filled the gaps in the offices left by members who were serving in the armed forces, and he edited the *London Bird Report* for four years, remaining on the editorial committee for a further three, and *The London Naturalist* for five years. He moved away from London in 1946 to become, for thirteen years, assistant editor of *The Countryman* at Burford in the Cotswolds, so he surrendered the various offices he held in the Society. His last direct involvement then was as a co-author of our New Naturalist volume, *The birds of the London Area since 1900,* published in 1957.

Richard was made an honorary vice-president of the Society in 1995 and was our president for 1999 and 2000. His first Presidential Address, delivered at the AGM on 6 December 1999 (*LN 79*) is a valuable history of 'The London Natural History Society in the 1930s and 1940s' from a personal and active viewpoint, whilst his second one, on 6 December 2000 (*LN 80*), 'The wildlife of the London Area in 2100. Crocodiles or polar bears?', is compelling reading for a different reason. In it he spoke of changes to our climate, flora and fauna based on history, anecdotes and personal observations, and ended with a short, well-considered, glance into the future.

In Richard's passing the world of natural history has lost one of its greatest contributors and we are proud to have been with him for over seventy years.

KEITH H. HYATT

Obituary

Richard and Enid Butler

RICHARD EDWARD BUTLER, B.Sc., FGS, 1917–2005

The death of Richard Butler in 2005 brought to an end an era within the London Natural History Society going back to the resumption of natural history and kindred studies after the Second World War. He was the last of a group embracing Cyril Castell, Dick Homes, Geoffrey Beven, Ted Bangerter, Bernard Byerley and Ted Lousley who contributed so much to the Society during the middle years of the twentieth century. Richard had, however, a significant disadvantage when compared with the others mentioned; they were all active in popular disciplines, ecology, ornithology, botany and entomology, whereas Richard was a geologist; for most of his time there was but minimal interest in that subject within the LNHS — indeed despite Richard's heroic efforts for many years he was unable to arrest a continuous decline in interest and activity; sadly in the end separate existence for the Section was not possible.

Richard had joined the LNHS in 1948 marrying Enid in the same year; he organized activity weekends and was deeply involved in our Centenary Exhibition in 1958 arranging exhibits at the Royal Exchange and being interviewed with Enid for the BBC. After serving on the LNHS Council for some years he became president of the Society for 1968 and 1969 — his Presidental Address being well received as he reminded everyone that:

> **"it is in Geology that we find the beginning and interdependance of all aspects of natural history".**

In 1994 he was belatedly appointed an honorary vice-president; he remained on Council and was always prepared to help and advise younger and less experienced officers (your author can recall countless personal kindnesses).

Born on 30 August 1917, his life was very nearly cut short for during the Second World War, after being part of a team operating searchlights on the east coast, he had a narrow escape when his barracks took a direct hit from a V-1 (doodlebug). Richard was at that time part of a research group specializing in long-range guns firing over the English Channel; his job involved the calibration of the muzzle velocity to ensure an accurate point of impact; later he took part in the communications lines directly after the D-Day landings — he attended the celebrations of the sixtieth anniversary of the landings with great and justifiable pride.

By profession, Richard taught chemistry and geology at a private school where he was also deeply involved in administration. He was a long-standing member of the Nonsuch Antiquarian Society, giving lectures to that organization for over twenty years. On retirement he taught geology at evening classes in the Dorking/Epsom area and in 1979 he encouraged his students to form what is now the Mole Valley Geological Society, being its active and well-respected president until his wife's ill health took his full attention — sadly Enid died in September 2003.

Whilst geology was Richard's first love and interest (he was a Fellow of the Geological Society) he was also an enthusiastic archaeologist, a field in which his wife had been active for many years. So keen was this interest that during their seventies they both organized and joined coach tours to Jordan, Egypt, Norway, Denmark and the Holy Land, tours of which embraced both disciplines.

A man of great personal charm, quietly spoken, always calm — he enriched many lives, helped and encouraged many students, young and old, and contributed in numerous ways to the well-being and administration of many societies, but always as a volunteer — the sort of man of whom one can truthfully say 'he made a difference — we shall miss him'.

A. J. Barrett

Obituary

ALWYNE WHEELER, HON. FLS, 1929–2005

Wyn Wheeler first joined the London Natural History Society as a Branch Associate in 1942 at the age of thirteen. He is best remembered now as our recorder for fishes for many years and as an active participant in several of the symposia that the LNHS organized. In 1958 he became secretary of the Ecology Section's Mammal Study Group, and it was in that year that his review 'The fishes of the London Area' was published in *The London Naturalist* **37**. Previously there had been no comprehensive review of London's fishes.

Alwyne Cooper Wheeler was born on 5 October 1929 at Chingford, Essex. He was educated at St Egbert's College, Chingford and then Chingford County High School where he obtained Higher School Certificate. He spent his national service in the Royal Army Medical Corps as a radiographer and clinical photographer in the UK and in Jamaica: there he pursued his interests during spare time as a member of the Natural History Society of Jamaica. On release from army service he took the advice of Dr Maurice Burton of the British Museum (Natural History) and applied there for the post of Assistant in the Fish Section of the Department of Zoology. Thus, on 1 July 1950 he began his long association with the Museum, eventually retiring in 1989 as a Principal Scientific Officer — no mean task for someone without a university qualification.

Wyn became one of the world's foremost authorities on fishes, a large and diverse group. His main specialities were the taxonomy of European fishes and work on many historical collections of taxonomic importance. Much of his

fieldwork was conducted on Atlantic trawlers, and also closer to home, wading and electro-fishing in the ponds of Epping Forest and on Wanstead Flats. In the 1960s, during the 'cod wars' with Iceland, he was sent on a four-month expedition to the North Atlantic fishing grounds to conduct trawl surveys. The aim was to look for fish that might be used as substitutes for cod. This, and subsequent voyages, produced specimens which greatly enhanced the Museum's collections. Wyn's organized approach to work enabled him to be active on many ichthyological fronts. For example, fish bones feature extensively in archeological sites but they are notoriously difficult to identify. Wyn developed great expertise in this field with the result that in 1989 he published, with Andrew Jones, and illustrated by his daughter Rosalind, *Fishes,* a volume in the Cambridge Manuals in Archaeology series. In the practical business of taxonomy, he had very strong views regarding the stability of scientific names, especially when strict adherence to the rules might result in well-established names being replaced to take account of inconvenient precedence. His views were published in 1990 in the *Bulletin of Zoological Nomenclature* **47**.

Wyn's most important publication was, arguably, *The fishes of the British Isles and north-west Europe* (1969). In the late 1960s, Wyn published several works under the pen name Allan Cooper, for example, *Fishes of the world* (1969) in the Hamlyn all-colour paperback series. In 1975, under his own name, he published *Fishes of the world*, which was revised several times, including in 1985 as *The world encyclopedia of fishes.*

Another of Wyn's great interests was the River Thames. Whilst compiling 'The fishes of the London Area', he became aware that the high levels of pollutants and consequent lack of dissolved oxygen were the reasons for the scarcity of fish. However, in 1964, an engineer involved in the construction of the new power station on the lower Thames at West Thurrock had found a tadpole fish on the cooling-water intake screens and brought it to the Museum for identification. Wyn followed this happy accident by commencing to monitor the evident return of fishes to the river. In this he was helped by people at power stations, with the cooperation of the Central Electricity Generating Board, by sampling fish strained off on cooling-water intake screens; by catch-lists from fishing competitions run by the Greater London Council; and in special netting surveys in collaboration with the Port of London Authority and the Ministry of Agriculture. By the end of 1973, the number of fish species recorded from the Thames had grown to 72 (it is currently 122). This work demonstrated the beneficial effects of the 'clean-up' of the River Thames, which was seen as a great success. Wyn always had time to talk to and encourage anyone who knew the river, be they fishermen, engineers, river authority personnel, naturalists, or members of the public. In 1979 he published the fruits of his lifelong interest in the river, *The tidal Thames: the history of a river and its fishes* (Routledge & Keegan Paul, London), an invaluable record and a fascinating read skilfully written.

Wyn Wheeler was a prominent member of The Linnean Society of London. Having been elected a fellow in 1978, he served as Zoological Curator from 1980 to 1994. During this period he overhauled the dried specimens of fishes, and assisted with the identification of citations in Linnaeus's zoological works and published his own historical introduction to the twelfth edition (1766) of Linnaeus's *Systema Naturae* (Natural History Museum, London, 1991). He was also a prominent member of the Society for the History of Natural History, serving on its Council, editing its journal for more than thirty years, and serving a term as president. Additionally, Wyn served on the Council of The Ray Society for many years and was its president from 1983 to 1985.

When Wyn retired from the Natural History Museum in 1989 he had been suffering from osteoarthritis for some time, and commuting, plus the need to walk long distances within the Museum, became too much for him. He

occasionally visited the Museum in his capacity as an official Scientific Associate, but he also worked at the Epping Forest Conservation Centre. Born, raised and resident in Essex, he never lost interest in his local wildlife and was active in the Essex Field Club. One of Wyn's last papers was 'Ponds and fishes in Epping Forest', which appeared in *The London Naturalist* **77** (1998). Not one to give in, Wyn offered to work on the then projected history of the LNHS using the Society's archival material. Sadly, although having started making detailed notes with his customary thoroughness, this was not to be, since having contracted Alzheimer's disease he became too ill to continue. He died on 19 June 2005.

I am grateful to Wyn's Museum colleague Oliver Crimmen for allowing me to quote from the detailed notes he had prepared following Wyn's death. Fuller obituaries of Wyn Wheeler, by Oliver Crimmen, have appeared in the *Journal of Fish Biology* **68** (2006), the *Archives of Natural History* **33** (2006) and *The Linnean* **22**(4) (2006). A bibliography of Wyn's publications is expected to be published in the *Archives of Natural History* in 2007.

As a colleague of Wyn Wheeler, working in the same building for some forty years, I was well aware of his constant cheerfulness and his readiness to help and advise on even the smallest matters. In his passing we have lost a good man.

KEITH H. HYATT

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London Natural History Society

(Registered Charity No. 206228)

Rules

Name

1. The name of the Society shall be the LONDON NATURAL HISTORY SOCIETY.

Objects

2. Its objects shall be the study and recording of natural history, archaeology and other kindred subjects especially within twenty miles of St Paul's Cathedral, the promotion of scientific investigations, the appreciation and conservation of the natural environment and the publication in the Society's journals of scientific and educational papers relating particularly to the London area.

Management

3. The affairs of the Society shall be managed by a Council of Trustees and by other committees and sub-committees to the extent that such duties shall be delegated thereto by Council in accordance with Rule 5(h). The Trustees shall comprise
   a) President, Secretary, and Treasurer, none of whom shall be the same person
   b) one representative from each Section who shall be elected at the Section's Annual General Meeting
   c) ten representatives of the members at large of whom no more than six shall be nominated by Council

   Members of Council other than Section representatives shall be elected at an Annual General Meeting.

4. a) The President shall hold office for two years. On relinquishing office he or she shall become a Vice-President for life.
   b) The Secretary and the Treasurer shall each hold office until the first Annual General Meeting next ensuing and on retirement shall immediately be eligible for re-election.
   c) Each representative member of Council shall hold office if re-elected until the fifth Annual General Meeting next ensuing and on retirement shall not be eligible for re-election until the Annual General Meeting one year after retirement.

5. Council shall have power:
   a) to fill any casual vacancy which may occur in any office or its number until the next Annual General Meeting
   b) to appoint a Librarian, and Editors of the Society's publications
   c) to appoint other officers
   d) to create and disband Sections
   e) to appoint a Patron of the Society
   f) to appoint Honorary Vice-Presidents who shall be Honorary Members
   g) to appoint Honorary Members

h) to delegate any of its powers (but not those named in 5(a) – 5(g) above nor its powers under Rule 18) to committees consisting of such Members of the Society whether or not members of Council as they think fit, and any committee so formed shall, in the exercise of the powers so delegated conform to any regulations and conditions imposed by Council. All acts and proceedings of any such committee shall be reported to Council as soon as practically possible

i) to regulate its own and the Society's procedure subject to these Rules.

6. a) There shall be not less than four ordinary meetings of Council in any year and not more than six months shall elapse between meetings. A Special Meeting of Council shall be convened within twenty-one days upon the requisition of not fewer than five Council members addressed to the Secretary and specifying the purpose for which the meeting is to be called.

b) A notice with the Agenda for the meeting shall be sent to each member of Council at least ten days before any ordinary or special meeting of Council is to take place.

c) Eight members of Council (including at least one of President, Secretary or Treasurer) shall form a quorum.

7. An Annual General Meeting of individual members of the Society shall be held in the month of December or thereabouts in every year to transact the following business:

a) receive and if approved adopt annual reports and a statement of accounts to the end of the last preceding financial year

b) elect from the members of the Society the officers and members of Council, other than Section representatives

c) elect auditors or independent examiners of accounts

d) deal with any special matter which Council desires to bring before the members and to receive suggestions from members for consideration by Council.

e) Nominations for election shall be submitted in writing to the Secretary at least ten days before the Annual General Meeting. The date of this meeting and the last date for nominations shall be notified to members not less than one month in advance.

8. The President, Secretary and Treasurer shall be *ex officio* members of all committees of Council and of Sections of the Society.

Finance

9. If the office of Treasurer shall at any time become vacant the accounts shall be audited immediately.

10. The income and property of the Society and all money received by or on behalf of the Society shall be applied solely towards the furtherance, promotion and execution of the objects of the Society and no portion thereof shall be paid by way of dividend, bonus or profit to any member of the Society, provided that nothing herein expressed or contained shall prevent the payment in good faith of remuneration or expenses or both to any member of the Society, or other person or persons for services actually rendered by him or them to the Society. All claims for expenses must be sent to the Treasurer and he may require such information in regard thereto as he may think fit. All monies payable to the Society shall be received by the Treasurer or such other officer as shall be appointed to receive same. All funds belonging to the Society shall (unless invested) be deposited in

banking accounts in the name of the Society or such other names as Council may authorize and no sum shall be drawn from these accounts except by cheque signed by such person or persons as Council shall direct. Any monies not required for immediate use may be invested by Council as herein authorized. Council shall cause true accounts to be kept of the receipts, expenditure, assets, credits and liabilities of the Society and shall place before members of the Society at each Annual General Meeting an audited or independently examined statement of financial activities and balance sheet made up to the end of the previous financial year.

Assets of the Society

11. a) All subscriptions of Members, and all other monies received by the Society, and not required for current expenses, may at the discretion of Council be invested for the benefit of the Society, and the annual income thereof, and of all other investments and property of the Society shall be applied at the discretion of Council for the purposes of the Society or may be reinvested.

    b) The Society may receive and disclaim property of any nature whether or not it is subject to any express conditions or trusts. The Society may acquire by purchase gift or otherwise, hold, and dispose of property of any nature, freehold or leasehold. Assets not required under Rule 11(a) for current expenses may also be invested in the name of a limited company established by and under the control of the Society for trust purposes or in the name of a nominee company or with the Official Custodian for Charities.

Membership

12. a) Application for membership is open to all (except a previous member expelled under Rule 18). Applicants shall become members after approval by Council and on payment of a first subscription.

    b) Any person who ceases to be a member of the Society howsoever shall automatically cease to hold any office of, or to be a member of any Committee of, the Society, and shall return to the Society any of its property in his possession.

13. The following are the categories of membership:

    a) ORDINARY MEMBERS.

    b) STUDENT MEMBERS — persons under the age of eighteen or receiving full-time education.

    c) HONORARY MEMBERS — persons who have been appointed by Council under Rule 5(f) or 5(g). Such members do not pay an annual subscription and are entitled to all the privileges of ordinary membership.

    d) FAMILY MEMBERS — members of the family of an Honorary, Ordinary, Senior or Student Member who live at the same address. Family Members do not receive copies of the Society's publications other than the *Programme*.

    e) CORPORATE SUBSCRIBERS — public and private organizations including other natural history societies, libraries, museums, botanical gardens, schools, consultancies and similar bodies. Corporate Subscribers are entitled to send representatives to any meeting of the Society. A Corporate Subscriber has one vote on any motion.

    f) SENIOR MEMBERS — persons over the age of 65 and who have been continuous members of the Society for ten complete years shall be entitled upon application to pay a reduced rate of subscription.

14. The annual subscription is payable on the first day of January and shall be an amount determined by Council.

15. The annual subscription of members who first join the Society on or after the first day of October in any year shall extend to the period ending on the thirty-first day of December of the following year.

16. Any member whose subscription shall be in arrears for nine months on the thirtieth day of September shall cease to be a member, and any sum being less than the due subscription received by the Society from a person whose subscription is in arrears shall be treated as a donation.

17. Members of the Society whose current subscription has been paid and Honorary Members are entitled:
    a) to receive a copy of the Society's journals and programmes as issued (except as provided under Rule 13(d))
    b) to attend all meetings of the Society and its Sections, to vote in person and to introduce visitors
    c) to have access to the Society's Library and Collections for borrowing or reference in accordance with arrangements laid down by Council.

18. a) Council may expel from the Society any member or remove from office any officer who refuses or fails to abide by these Rules or who is guilty of conduct which in its opinion is prejudicial to the Society. Every resolution for expulsion or removal must appear on the agenda of the Council meeting and must be passed by the votes of not less than two thirds of the members of Council present. At least ten days before any such resolution is discussed the member or officer whose conduct is in question shall be informed of the nature of the complaint and be given an opportunity of appearing before Council for the purpose of giving an explanation or denying the truth of the complaint. Every vote under this rule shall be conducted by ballot and no ballot paper shall contain any indication of the voter's name. All discussion on any resolution appearing on the agenda under this Rule shall be secret and there may only be published the name of any member who is expelled or officer removed hereunder. The member or officer concerned shall be informed of the decision within three weeks of the meeting of Council.
    b) Any member so expelled shall forfeit all rights in and claims upon the Society or its property.

19. The rights and liabilities of members shall not be transferable.

Sections

20. The Society shall be constituted in such Sections as shall be sanctioned from time to time by Council which may at any time disband a Section.

21. The affairs of each Section shall be managed by a Committee consisting of Chairman, Secretary (who shall not also be Chairman) and not less than three other elected members.

22. The Sectional officers and members of the Committee including the representative to Council shall be elected annually at the Section's Annual General Meeting which shall be held each year before the Annual General Meeting of the Society. The Committee shall have power to fill any vacancies and to co-opt during its term of office.

23. The Committee shall meet not less than twice in any year and not more than nine months shall elapse between meetings.

24. A report recording a Section's activities during the preceding year shall be submitted for adoption by the members at the Section's Annual General Meeting. Subject to the approval of Council this report or extracts therefrom may be published in one of the Society's journals.

25. A Section shall manage its finances from grants made by Council. A financial statement shall be submitted for adoption by the members at the Section's Annual General Meeting and a copy sent to the Treasurer who may require it to be audited.

26. Sections shall observe and act in conformity with any directions published by Council from time to time. Any property acquired by a Section shall be held on trust for the general objects of the Society. If any Section is disbanded its accounts shall be audited by the Society's auditors or independent examiners and all money, property, books and papers of which it had the use administered as directed by Council.

Special General Meetings

27. A Special General Meeting of the Society shall be convened upon the requisition of Council or of ten per cent of the membership; such requisition shall be addressed to the Secretary, and shall specify the purpose for which the meeting is to be called. A notice shall be sent to each member of the Society at least twenty-one days before the meeting is to take place.

Alteration to Rules

28. The Rules of the Society may be altered at the Annual General Meeting or at a Special General Meeting and at least twenty-one days' notice of any meeting to consider a proposed alteration shall be given to all members. The notice shall state the proposed change or changes. In order to effect an alteration of a Rule, a majority of the members actually present and voting at the meeting shall vote in favour of the proposed change. No amendments to any proposed alteration shall be allowed.

    No amendment to Rule 2 (Objects) or this Rule, or Rule 32 (Dissolution) shall take effect without the written consent of the Charity Commission thereto except as permitted by statutes in force at the time.

29. Any ambiguity or difference of opinion concerning the purport or interpretation of any Rule or any other matter not provided for in these Rules shall be referred to Council whose decision shall be final and binding.

Notices

30. The accidental omission to give notice of a meeting to, or the non-receipt of notice of a meeting by, any member shall not invalidate any proceedings or resolutions at any meeting of the Society or any Committee or Section thereof.

Records and minutes

31. Records shall be taken and minutes kept in such forms as Council may direct of the proceedings at all General meetings, at all meetings of Council and of every committee, sub-committee or working party of the Society and its Sections and the minutes of every such meeting shall be confirmed at and signed by the Chairman of a subsequent meeting and when so confirmed and signed shall be conclusive as to all matters and things therein recorded and purported to have been done or directed to be done. A resolution in writing signed and agreed to by all members of Council for the time being in the United Kingdom shall be as valid and effectual as if it

had been passed at a meeting of Council duly called and held and may consist of several documents in the like form each signed by one or more members of Council.

Dissolution

32. A motion to dissolve the Society may only be made at a Special General Meeting and to effect a dissolution at least three quarters of the members actually present and voting at the meeting shall vote in favour of the dissolution. If a motion to dissolve the Society is carried by the said majority the Society's surplus funds, property and assets (if any) shall be disposed of for charitable purposes in connection with education and research particularly for such charitable purposes of education and research in connection with natural history as the members may at the said Special General Meeting decide to the intent that no member of the Society shall receive any of the said funds, property and assets by virtue of his membership. A statement of the reasons for advocating dissolution shall be sent to each member with the notice of the Special General Meeting.

Approved at the Annual General Meeting of the Society,

6 December 2005

The London Naturalist

Instructions to contributors

Submission of papers

Papers **must be submitted in duplicate** to the editor, Mr K. H. Hyatt at his home address, 1 Tremcelynog, Rhandirmwyn, Llandovery, Carmarthenshire SA20 0NU. Please contact the editor before the end of January if you wish to contribute to the forthcoming issue. However, the editor may be contacted at any time on 01550 760346 to discuss possible contributions, and will be pleased to send a recent offprint to show our style, and as a guide to preparing the manuscript, **which should be followed as closely as possible in regard to layout and typefaces.** Manuscripts **must be double spaced throughout on one side of the paper only** and with wide (3-cm) margins. **Authors must retain a copy.** Papers should include at the beginning an **abstract, summary** or **synopsis. Sheets must be numbered.** Papers are peer-reviewed as appropriate. After acceptance, the editor would be pleased to receive contributions as Microsoft Word-compatible files **together with two matching hard copies of the final text.** Papers should be relevant to the natural history and archaeology of the London Area. This includes comparisons between London and its surrounding countryside with other localities, as well as work relating to or comparing species or habitats which occur in the London Area. Contributions of relevance nationally will also be considered.

Text

Locality spellings should follow the latest editions of maps published by the Ordnance Survey. Capitalization should be kept to a minimum. Common names of animals and plants must begin with lower-case initials (except for proper nouns), and **only** Latin names of genera and species must be underlined unless typed in italic. When both common and Latin names are given there should be no brackets or commas separating them. **Genus names should appear in full where first used within each paragraph.** When scientific names are taken from a standard work, which must be cited, authorities should be omitted. In descriptive matter numbers up to a hundred should be in words, except in a strictly numerical context. Dates should follow the logical sequence of day, month, year, i.e., 25 December 1971, but in lists may be as 25.xii.1971. Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs, or St. Lists should be in systematic, alphabetic or numerical order. **Hyphens should not appear at the ends of lines** as the right-hand margins of manuscripts do not need to be justified: **turn off the hyphenation option. Tables and figure legends should be typed on separate sheets at the end of the text. Word-processed text should not use italic, bold or compressed typeface. Paragraphs should be indented. Sentences must not begin with numerals.**

References

Reference citation should be based on the Madison rules (*Bull. Torrey bot. Club* **22:** 130–132 (1895)), except that a colon should always precede a page number. Capitalization in titles of books and papers in journals should be kept to a minimum. Journal titles should be in full, or follow the abbreviations in the *World list of scientific periodicals*, and be underlined or in italics. Book titles should also be underlined or in italics.

Examples are as follows:

In text:

Meadows (1970: 80) or (Meadows 1970).

In references:

MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964–9. *Lond. Nat.* **49:** 76–81.

MELLANBY, K. 1970. *Pesticides and pollution.* Ed.2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* **92:** 39–45.

Authors must ensure that all references are cited accurately: they will not be checked by the editor.

Illustrations

Distribution maps should be submitted in the form of a recording map with symbols in Indian ink and stencilled or by transfers, e.g., 'Letraset'. Solid dots are used to indicate contemporary or recent presence, circles for old records, and crosses (not pluses) for other information, such as introduced species. The caption should be written outside the frame of the map and will be set up by the printer. Scale bars must be included **within** the frame of the map.

Line drawings should be in Indian ink on white card or tracing paper, larger than the printed size, but no larger than A4. Place names, etc., must be produced with stencils, Letraset, or with sharp typing. Captions should be separate as they will be set up by the printer, but keys that include special characters should be included **within** the border of the figure.

Photographs should be glossy black-and-white prints, of good contrast, preferably plate or half-plate in size, or, following consultation with the editor, in the form of colour transparencies, either 35 mm or larger. Colour prints are also suitable for reproduction in the text in black and white.

Proofs

Proofs will be sent to authors for scrutiny, but only essential corrections can be made at that stage.

Offprints and reprints

Up to 25 free, unbacked offprints will be supplied on request. Additional copies may be purchased if ordered when the proofs are returned.

Backed and folded, wire-stitched reprints, with or without covers, may be purchased by authors following consultation with the editor.

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